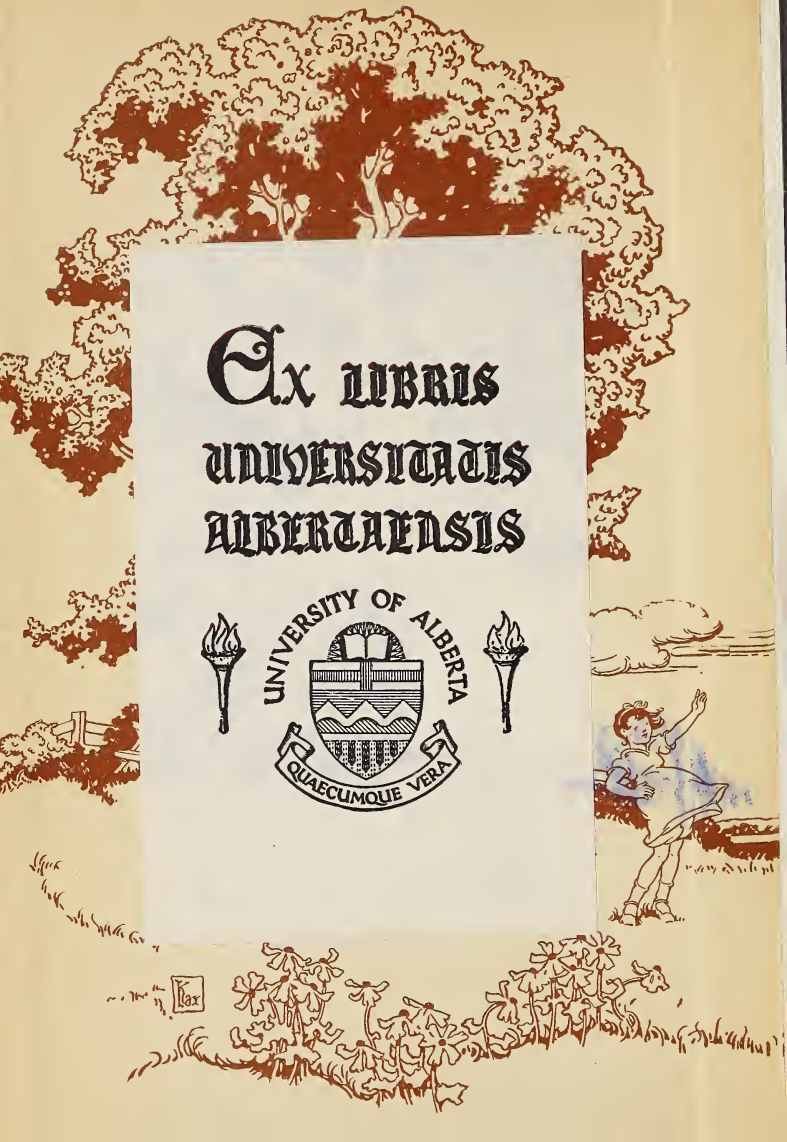
PATHWAYS IN SCIENCE
OUT-OF-DOORS

CRAIG AND BALDWIN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PATHWAYS · IN · SCIENCE · II
A COURSE FOR ELEMENTARY SCHOOLS

Out-of-Doors

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PATHWAYS · IN · SCIENCE
A UNIFIED COURSE FOR ELEMENTARY SCHOOLS

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Preface

Pathways in Science is designed to meet the demands of the modern tendency to introduce science as an essential part of the elementary-school curriculum by presenting a course of carefully graded problems in science for Grades I to VI.

The content of this series is the result of a study of science in all grades of the elementary school. Based originally upon the "Horace Mann Course of Study in Elementary Science"[1] and upon "Certain Techniques Used in Developing a Course of Study in Science,"[2] it has involved searching analyses of several thousand children's questions, of educated laymen's needs in science, of courses of study, and of worth-while scientific concepts.

The series definitely conforms to the recommendations and the spirit of the Thirty-first Yearbook, Part I, of the National Society for the Study of Education, and the requirements of recent state and city courses of study in elementary science.

[1] Horace Mann Course of Study in Elementary Science, Bureau of Publications, Teachers College, Columbia University, New York City, 1927.

[2] Certain Techniques Used in Developing a Course of Study in Science for the Horace Mann Elementary School, Bureau of Publications, Teachers College, Columbia University, New York City, 1927.

Each volume of the series has been organized about a number of units. These units present a series of problems, each of which offers a real challenge to children. Sufficient information is given in the text to lead to a satisfactory solution of the problem and to an understanding of the essential meanings that are involved in the presentation.

"Out-of-Doors" purposes to stimulate interest in the out-of-doors and to assist children in observing and interpreting the things which go on in the natural world around them. The plan of the book is built around the theme of seasonal change. The organization includes preparation made by people, animals, and plants for the change of seasons. It also includes problems which develop experiences which have to do with changes in weather, and which recognize relationships that the child has with the sun and the moon. Attention is given to the subject of the formation of soil and rocks. Life histories of several of our better-known wild animals are presented from the standpoint of children's desire for acquaintance with the animals about them.

A manual for the teacher accompanies "Out-of-Doors," giving additional information and activities. The manual will prove to be especially helpful

to those teachers who are giving instruction in science for the first time. By making use of the manual, which includes a carefully prepared bibliography for teachers, it is possible for classroom teachers to secure considerable training for the teaching of elementary science while conducting the course.

The vocabulary has been checked throughout by the use of the Buckingham-Dolch Word List. Whenever over-grade words are needed for the enrichment of the science vocabulary of the children, they are carefully explained in the text.

The authors are indebted especially to Dr. B. R. Buckingham for the encouragement and advice that he has given in this undertaking.

G. S. C.
S. E. B.

Contents

OUT-OF-DOORS

UNIT I

Changes Out-of-Doors

I · CHANGES IN THE FALL

1. Taking a Walk

Do you like to take walks in the woods, fields, or parks? New things are always happening out-of-doors.

Take a walk when school begins in the fall. You can see the trees change to their bright colors. Trees are a cool green in the summer. In the fall their leaves turn to bright red or yellow or gold or brown. Some trees wear two or three of these colors at the same time.

You can look at the bright wild flowers. Goldenrod and purple asters have colors fine enough for a king. The goldenrod is as yellow as the king's crown of gold. The asters are as purple as his velvet robe.

Take a walk late in the fall. You will see more changes.

The yellow goldenrod and the purple asters have grown brown and stiff.

The trees have lost their beautiful colored leaves. The branches look brown and bare. If you look hard you can see something on the branches. On the branches are many, many buds. There are hundreds of buds on every tree. In the spring these buds will open. New leaves and flowers will come out of these buds.

Watch the sky in the fall. At this time the sky is a busy place. Many birds are flying south. The wild geese follow a leader. They fly over your head like so many army airplanes.

Swallows circle about. They look like leaves falling from a tree. Hundreds of them fly over our heads at a time.

You can see many seeds in the fall. Burdocks and sticktights hang on to your clothes. The first thing you know, you have dropped them and have planted them. The blossom of Queen

Anne's lace dries into a round ball with the seeds inside. What can you tell about the seeds of other wild flowers? What can you tell about the seeds of the garden flowers?

When you take walks in the fall, you can hunt for nuts. It is fun to see how many kinds of nuts you can find. Sometimes you can find enough nuts for a party. Sometimes you can find enough to give the squirrels a winter party.

You can hunt for cocoons in the fall. Do you know how a cocoon looks? Here is a picture of one. This caterpillar has wrapped a leaf around itself. It made a blanket of silk inside. Later you will find out more about cocoons. It is fun to watch a moth come out of its cocoon in the spring.

Do you like to hear the crickets chirp? Do you like to hear the call of the katydids and the hum of the locusts? Late in the summer and early in the fall you can hear these sounds. When the grass is brown and the trees are bare, these sounds are still. Where are the insects which kept the air so busy?

Listen for the singing of the birds in the fall. Do they sing very much when winter is coming on? Do you know why they are not singing?

If you take many walks in the fall, you see more changes in your out-of-door pictures. Can you tell what these changes are? What happens to the bright flowers in the gardens? What happens to the vegetables? How does the grass look?

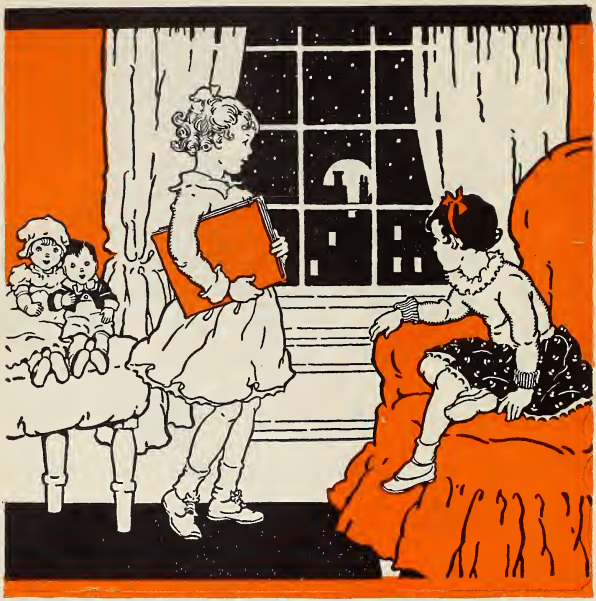
2. Short Days in the Fall

Another great change takes place in the fall. Can you play out-of-doors after supper in the fall? Why not?

In the summer evenings Mary and Jane had a long playtime. They could play out-of-doors until bedtime. It

stayed light for a long time. They went to bed at eight o'clock. Sometimes it was still light at eight o'clock.

In the fall evenings they could not play outside after supper. They had to play games in the house. When their



supper was finished at half past six, night had come. The stars were shining in the dark sky. Sometimes the moon was shining, too. The electric street lamps were lighted. People had turned on the lights in their houses.

The morning sun always awoke Mary and Jane. In the summer time they woke up so early that their mother said: "When the sun comes into the window do not get up and play. Pull down the curtain and try to go back to sleep. You do not get enough sleep when your day begins so early." So in the early summer mornings Jane and Mary pulled down their curtain. Then the bright early sun did not keep them awake.

In the fall the children had plenty of time to sleep. After the sun woke them up, there was just enough time to wash, dress, have their breakfast, and go to school.

In the fall the nights are very long. They are longer than the nights in the

summer. The fall days are much shorter than the summer days. Each day is a little shorter than the day before. Each night is a little longer. When winter comes, nights are longer than days.

In the fall the out-of-doors changes every day. The weather grows colder and colder. By and by fall is no longer here. Winter is here instead.

Did you ever take a walk in the fields or woods in the winter? Many more changes can be seen then.

You surely will want to take some walks in the spring. What changes do you think you might see in the out-of-doors then? What about the trees? What about the birds? What happens to the flowers? What happens to the insects?

Things to Do

1. With your crayons make a picture of the out-of-doors in the fall. Have some trees in your picture. Put some grass and some flowers in your picture too.

2. Make another picture showing how the first picture would look if it were winter instead of fall.

How would your picture look if it were spring instead of fall?

II · HOW PEOPLE GET READY FOR WINTER

1. Warm Clothing

What clothes shall we wear?

Do you like to draw pictures? Here is something that is fun to do.

Draw a summer picture and a winter picture.

Draw two things in the summer picture to show that it is summer. Flowers make a picture look like summer. What else can you draw to make the picture look like summer?

Draw two things in the winter picture to show that it is winter. How would the trees look? What else can you draw to make the picture look like winter?

Now draw yourself in each picture. How will you be dressed in the summer picture? How will you be dressed in the winter picture?

Here are some words which tell about the clothes people wear. Which words go with your summer picture? Which words go with your winter picture?

warm coat	thin suit	wool dress
thin dress	half-socks	wool suit
fur collar	no hat	wool cap
long stockings	overshoes	leggings
bare feet	bare arms	sweater

Why we wear warm clothes

Do you know why we need to wear these warm clothes in winter? The heat from our bodies does not go out through wool very quickly. Our bodies

stay warm and comfortable when we wear these clothes made of wool, because the heat stays inside.

The Eskimos live where there is ice and snow almost all the time. They wear clothes made of fur. Their coats and trousers and hats and shoes are all

made of fur. Fur is warmer than wool. The heat does not go out through it easily.

Even the Eskimo babies wear little fur suits. Inside these suits are the soft feathers of birds. Feathers hold in the heat as well as fur does. An Eskimo baby in his clothes of fur and feathers does not feel the cold winds.

Many people live in places which are very cold in winter. They must find some way to have warm clothes. If we wear plenty of warm clothes, we can be comfortable in freezing cold weather.

In summer we do not wear warm clothes. We wear cotton or linen clothes. We do not want to hold the heat close to our bodies. The cotton or linen cloth lets the heat get away from our bodies. Our

bodies are quite comfortable when the heat can go out through our clothes.

Some places in the world have summer all the year. What kind of clothes do you think people wear in these warm places? Why do these clothes help the people to stay cool?

2. Warm Houses

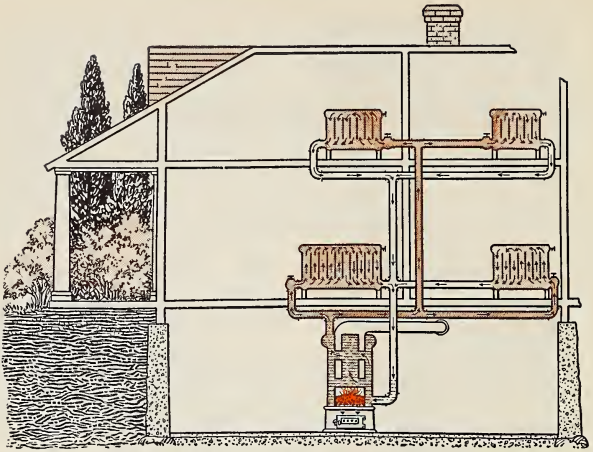
What keeps our houses warm?

In the winter time people try very hard to keep their houses warm. Most houses are almost as warm in the winter as they are in the summer.

We do not need to wear our warm wraps in the house. The heat that is made for our houses keeps people warm without wraps. We must take off our wraps when we come into the house. If we do not take off our wraps in the house, we are cold when we go out-of-doors.

Tell all you can about how your house is kept warm.

Ask your mother or father to show you all about the furnace which heats



your house. See how the pipes go out of the furnace to the rooms above. These pipes carry heat. Sometimes the pipes connect with a boiler. This boiler sends out steam through the pipes to the rest of the house. Steam is very hot. It keeps a house warm and comfortable.

Is your house heated by a stove instead of a furnace? Then ask your

mother or father to show you how the stove is able to give out heat.

Much work has to be done to keep houses warm. Men work hard to dig the coal out of the ground. They stay under the ground all day. Day after day they dig the coal and load it on to cars. The coal or oil which goes into your furnace costs a great deal of money. Someone has to work hard to get the money to pay for it.

Some people burn wood in their stoves. Cutting wood is very hard work, too. Chop, chop, chop! Day after day the men chop down trees. Then the wood must be sawed into pieces. The pieces must be cut small enough to fit into a stove. Great piles of wood are needed to last through the winter.

Old-time ways of keeping warm

Years ago no one had stoves or furnaces. Fireplaces were used to heat the houses. The women did all their cooking in the fireplaces. Do you think the houses were as warm in those days as they are now?

Thousands of years ago people did not live in houses at all. They lived in caves. Some of these caves were made

of rock. Some of them were dug out of the side of a hill. The cave men built their fires at the doorways of the caves. How closely they sat around the fire during the cold winter days and nights! In the summer these cave men could not get wood ready for the winter. They had too many other things to do. Sometimes they had a hard time to find enough wood to keep their fires going in winter. The cave people were always glad when the winter was over.

Now people plan ahead for the winter. They order their coal or they cut their wood long before winter has begun. If they did not do this, everyone would be wanting coal and wood at the same time. Would it be wise for people not to plan ahead? Why not?

3. Food for Winter

Pickles, jelly, and dried apples

Jack and Helen lived on a farm. They liked fall days because they could smell such good smells.

"I like to smell jelly cooking," said Jack.

"I like to smell spiced pears," said Helen.

"I love to smell chili sauce," said Jack.

"I love to smell catsup," said Helen.

Their mother let them taste the good things she was making.

"We must not eat these good things now," their mother told them. "We must save them until next winter. The plums and pears and peaches will be

gone from the trees. The berries will be gone from the bushes. We must save the pickles and jelly to eat in their places."

During the summer Jack and Helen had watched their mother can many kinds of fruit. Sometimes they were able to help their mother very much.

They helped their mother to dry corn and apples. They watched the apples and the corn very carefully. They did not let the food spoil. They kept it covered with a clean cloth so that the dust would not touch it.

Afterwards the apples and corn were kept in a dry place. The canned fruit, the jelly, the chili sauce, the catsup, and the pickles were kept down in the cellar.

Food from the garden and orchard

Mr. Stone was Jack and Helen's father. Mr. Stone was a very busy man in the fall. He, too, had to get food ready for the winter. He brought in potatoes from the potato field. He brought in apples from the orchards. He brought turnips, cabbages, and

onions from the garden. Some of these were sold to people who did not live on farms. The rest were kept in the cellar, to be eaten by the family during the winter.

When Jack and Helen ate the jelly

and canned fruit during the winter, they often said, "This tastes just as good as it smelled last fall."

Their mother said, "The vegetables do not look so pretty or smell so fine as the fruits, but they are just as good for hungry children."

Helen and Jack thought that fall is a very important time of year. Can you tell why? Do you think so, too?

How do city people get food in winter?

Mrs. Stone put away much food for the winter. Many people do not have time to do so much canning. Many people have no place to put so many jars of fruit, jelly, and pickles. They have no place to keep the apples and potatoes and other vegetables. Can you tell

how these people have enough food in winter? Where is their food for winter?

Do you like to go to the grocery store? Do you like to look at the shelves full of canned goods? Red cans, blue cans, green cans, yellow cans — all full of food. The store sells canned

fruit, canned vegetables, canned fish, canned meat—foods of every kind.

Do you like to look at the boxes of fruit and vegetables? Red apples, yellow grapefruit, oranges, blue plums, green lettuce, orange carrots, red beets. Do you like to see the pretty colors? Do you like to look at so much good food?

In the summer the city markets have dozens of different kinds of fruit and vegetables. In the winter they have almost as many different kinds. We can buy lettuce, string beans, peas, and spinach. We can buy grapes, pears, cherries, or strawberries. We can buy nearly all the summer vegetables and fruits.

These vegetables and fruits will not

keep all winter. They will spoil if they are kept many days after they are picked. Do you know why we can have so many kinds of vegetables in the winter markets?

During the winter, vegetables are growing in the gardens in the warm South. Fast trains bring the vegetables from these gardens to our cold cities in the North.

These trains have cars which are like big refrigerators. The refrigerator cars keep the vegetables cool and fresh during their long ride.

When the trains reach the North the vegetables do not freeze. The thick walls of the refrigerator cars keep the cold outside air from touching the vegetables. The refrigerator cars are just

cold enough to keep things fresh. The air does not freeze the vegetables. In a few days they are in the markets of cities where winter is cold. In a few more days people have bought them and have eaten them all up.

Years ago trains did not have refrigerator cars. The trains did not run so fast. Vegetables could not be brought from the gardens in the South. They would be quite sure to spoil before they reached the city markets. People had only the vegetables which would keep all winter.

What a lot of ways there are to have good food in the winter time! Which of these ways do your parents use to get the kind of food you need in the winter?

Do you know of any other way by which people keep food for the winter?

Things to Think About

1. Do you think you could take care of yourself in the winter without any help from anybody? If you were a squirrel or a rabbit, you would have to do so, wouldn't you? You would have to find your own food. You would have to make your own house to keep you safe from storms. You would have only your fur to keep you warm.

2. Do you think you could find all your winter food, build your house, and make your own clothes? That would be very hard for any one person to do. People think and plan about getting ready for winter. They plan what would be the quickest and easiest way

to take care of themselves. People help each other. A great many people help us to get ready for winter.

Things to Do

Should you like to dry some apples as Jack and Helen did? Here are a few things you will need:

A few good apples.
A knife for peeling the apples.
Some pieces of clean cloth.
A large needle with a big eye.
Some string.

Do not take too many apples, because you may not have room for them.

1. Pare your apples carefully. Cut your apples in two pieces. Cut each piece into two pieces. Now cut out the place where the seeds are. Cut each of these pieces into two or three slices.

2. Wash your apples. Dry them on a large clean cloth.

3. Now take your needle and string. String your apples on your cord like a string of beads. You can hang up your strings of apples like little clotheslines or you can tie the ends together. Hang them to dry over a cord which has been fastened up in a dry place.

4. They will dry out-of-doors or in-doors. Choose the place in which they will dry better. If they are out-of-doors you must bring them in at night.

5. You must keep your apples covered with a thin cloth. The dust should be kept away from them. See that the apples do not hang too close together. They will spoil if they are squeezed closely together.

6. When the apples are dried, put them in clean boxes or paper bags.

7. Dried apples make good apple sauce. You can have some for a party.

8. You can buy dried fruits at the store. Prunes, apricots, and figs are dried fruits. They are dried in great factories. These factories are near the farms where the fruit grows. It is fun to cook prunes or figs for a school party.

III · HOW ANIMALS GET READY FOR WINTER

1. What Winter Means to the Animals

Do you think that animals are as safe in the winter as people are? What are your reasons?

People are always finding new ways to care for themselves. Each year quicker and better ways are found. Animals have to go on in much the same way, year after year.

Their ways for taking care of themselves are good ways. If they were not, the animals could not live. But their ways do not change.

People can think and plan. Can the animals do this?

What do you think are some of the troubles which animals have in the winter?

Getting food is one great trouble. Winter does not have so much food for animals as summer does. Tell some of the kinds of food which you think animals have in summer but do not have in winter.

Food is often hard to find in winter. Some of it is covered with snow. Some of it is covered with ice after a freezing rain. Some of the insect food is hiding away in the bark of trees. Some of the animal food is under the ground.

Do you wonder how animals find food in the winter? Each kind of animal has some way of taking care of itself. Here are some of the ways.

2. How Birds Live in the Winter

Many birds do not stay in the frozen north during the winter. All through the fall the sky is a busy place. Many birds are flying to their winter homes in the south. In the south the air is warm. In the south there is plenty of food for birds.

Blackbirds pass in great crowds over our heads. Orioles, wrens, robins, and bluebirds travel in small flocks. The wild ducks and geese sail across the sky on their way to the south. Even the tiny humming birds take long trips to their winter homes.

Many birds do stay in the north during the winter. There is not so much food for the birds in winter as there is

in summer. But neither are there so many birds to eat the food in winter.

The winter birds eat buds from trees and bushes. They eat dried berries which are still on the vines. They like dried fruits which have been left on the trees. They eat many kinds of seeds. Some birds like acorns and other soft-shelled nuts.

Perhaps many birds which go south could keep warm in the north during the winter. Their coats of feathers are thick and warm. Birds keep warm more easily when they puff out their feathers. Did you ever see a bird with his feathers puffed out, looking like a soft feather ball?

There are many places for birds to stay in the winter. They sit in the branches of the evergreen trees. They crawl into bushes. They hide under great bunches of grass. Often the snow falls over them and gives them a cover of warm snow. When the storm is over they shake the snow from their feathers and set out to find more food.

Things to Do

Of course winter food is often hard for the birds to find. Should you like to give them food? Here are some foods which winter birds like:

cracker crumbs	meal worms
bread crumbs	bird seed
pieces of apple	nut meats
cracked corn	rolled oats
oats or wheat	pumpkin seeds
cooked meat	rice

Be sure to put your food where it will not blow away. Try to find a place which is out of the snow and rain.

3. How Insects Live through the Winter

When you take walks in the early fall, the air seems full of the sound of insects. Crickets sing, bees hum, flies buzz, katydids call.

Late in the fall and in the winter these sounds are still. You do not see the insects in the grass. You do not see them on the trees or in the air. Where are the insects in winter?

Some insects are in the egg

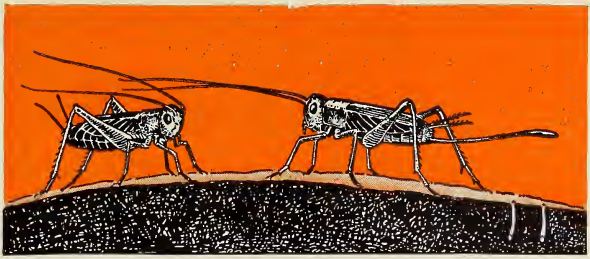
Many insects die when winter comes. But before they die they lay eggs. Then there are sure to be more insects of that kind in the spring.

The eggs of insects do not need

much care. The insects do not need to sit on their eggs as birds do. The eggs do not need to be kept very warm in order that the new insects may hatch. Hatch means to come out of the egg.

Most insects do not feed the little ones. The eggs are laid near food which their babies can eat as soon as they are hatched. The new insects eat this food until they are large enough to find other food which will make them grow. They do not need help from their parents.

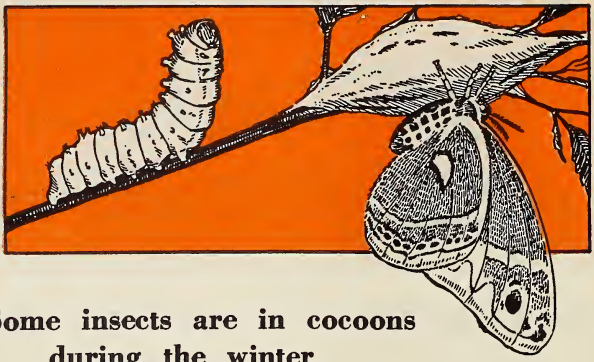
Did you ever hear the happy song of the crickets? Crickets are shiny black insects. You can hear their songs in fields and lawns. They make their homes in the grass or under stones. Sometimes we find green crickets in low bushes



and trees. Their song is quite as happy as the song of the black cricket.

In the fall the crickets lay their eggs in little holes near the top of the ground. After the eggs are laid, most crickets die.

Crickets like many kinds of food. They eat grass, insects, vegetables, and fruits. They will even eat clothes. When the little crickets hatch out of the eggs in July, they have no trouble in getting food. They will eat almost anything that they can find.



Some insects are in cocoons during the winter

Many insects change a great deal from the time they hatch from the egg until they are full grown. This happens to many of the moths and butterflies.

A caterpillar comes out of the egg. It eats and grows. Then a great change takes place. The caterpillar stops crawling about. It stops eating. It seems to be resting. But many things are happening to its body.

When this changing time comes

some caterpillars spin cocoons around themselves. Many kinds of cocoons are fastened to trees and bushes. Some caterpillars fasten their bodies to a leaf. There they hang while the change is taking place. Other caterpillars crawl into the cracks in the bark of trees or under stones. All find a place which seems to be safe from harm.

In the spring a beautiful moth comes out of the cocoon which held a caterpillar in the fall. The caterpillar that fastened itself to a leaf becomes a bright-colored butterfly. What a wonderful change this is!

Very soon the moths and butterflies lay eggs. These eggs are laid in gardens, on trees, bushes, or other plants. They are laid near food which the young caterpillars can eat when they hatch.

Soon after the eggs are laid, most moths and butterflies die. The young caterpillars grow until fall. Then they too go into a changing stage. And the story takes place all over again.

Some insects stay in the ground all winter

When the cold fall days come, most insects have a hard time to find food. Many insects take an easy way to get ready for winter. They crawl into the ground and stay there until warm spring days come again.

Did you ever see the pretty little potato beetle? He has black and yellow stripes, or lines, on his wings, which cover his back. People who have potato plants do not like this little insect. The

potato beetles would eat all the plants in the garden if they were not stopped.

In June and in August they lay their eggs. They lay them on the under side of the leaves of the potato plant. This is fine food for the new insects to eat. The young insects do not look like their parents. They are red and have no wings. In two or three weeks they crawl into the ground, where they stay for about two weeks. When they come out of the ground, they look like their parents. Now they, too, have wings with black and yellow stripes on them. They will go on eating potato leaves until fall if the farmer does not stop them. When the plants die in the fall, this beetle crawls into the ground as its parents did the year before.

Things to Think About

1. If you bring insects to school, you must feed them. Be sure to bring leaves from the plant where the insects were feeding. They may not be able to eat the leaves from any other plant.

2. Be sure that you have a good place to keep the insects after you have brought them to school. They must have air. The place where you keep them in school must be as nearly like the place you found the insects as you can make it.

4. Some Animals Stay in the Ground All Winter

Turtles, toads, frogs, and many snakes have an easy way of living in the winter. They do not try to find food

at this time. They go to sleep instead. They sleep and sleep all winter long.

They crawl into the mud for their naps. Some of them dig deep holes. They must go deeper than the frost will go.

The toads go in backward. They dig with their hind feet. The dirt falls down in front and covers them. It is like sliding under bedclothes on a cold night.

When spring comes, the sun warms the ground. The warm ground wakes up these sleepers. They crawl out to eat the food which is now ready for them.

5. Some Animals Build Winter Homes

Muskrats and beavers build beautiful houses, where they stay through the cold winter months. The muskrat builds his house in a swamp or along the bank of a stream. If the muskrat's house is in the bank of the stream, it is just a big tunnel, or burrow. If he builds in a swamp, he makes a big pile of grass, stems, roots, and mud. This house reaches safely up out of the water.

Both kinds of houses have a tunnel leading into the water. The muskrats can go down into the water for fish and water plants. There is a room above the water where they can eat and sleep. A number of muskrats

live together. They can keep warm and comfortable during freezing weather.

When they have no other food, they can eat the stems and roots of which their houses are made. Muskrats often store food in their houses. Sometimes they put away apples or potatoes.

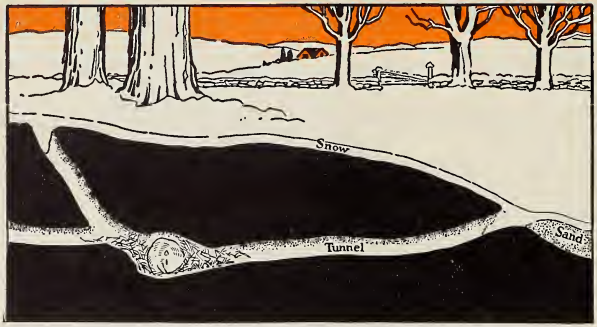
Beavers' houses are much like the muskrats' houses. They are larger and more carefully built. Beavers use larger branches.

Beavers and muskrats lead a busy life in the winter. They spend much of their night time looking for food. They have plenty of time to sleep. They sleep during the day. Then they are safe from snow and cold. They are safe from animals which like them for food.

6. Some Animals Take Long Winter Naps

Chipmunks, woodchucks, raccoons, badgers, gophers, skunks, and bears are great winter sleepers.

The woodchucks go to sleep in the fall and sleep on and on until the spring. They sleep so soundly that a firecracker would not wake them up. If you could see one in the winter, you



would think he was dead. Only warm days will wake them up. The warm spring sun makes them come out of their holes after their long winter's sleep.

The woodchuck has a very comfortable home under the ground. There is a large room where he sleeps. This room has a tunnel leading to the front door. It has several tunnels leading to back doors. In the spring this room is used for the baby woodchucks.

The chipmunk makes a very fine little house under the ground. He has long tunnels, too. He has two rooms. One room is used for a sleeping room. The other room is for the food he needs in the winter.

The chipmunk does not sleep all winter as the woodchuck does. He takes long naps when the weather is very cold. But he wakes up when the days are warm. Then he has a big dinner on the food he has brought into his little house.

Skunks do not make winter homes. They find a warm spot under a barn, in an old woodchuck's hole, under tree roots, or by fallen trees. They take long naps when it is very cold. They come out of their hiding places for

food when the days are warmer. They eat mice, seeds, or berries. They eat almost any small food they can find.

Woodchucks, badgers, and raccoons live on their fat during the winter. In the spring the raccoons are very very thin.

Bears, too, are helped through the winter because they are so fat. In the fall the mother bear crawls into a cave or some safe place where she can sleep. She stays there all winter. She has

nothing but her fat to keep her from being hungry.

The father bear takes long winter naps. But he comes out of his hiding place once in a while and looks about for food. He eats a little bark or some nuts or a fish, but he soon goes back for another nap.

In the spring there is plenty of food which bears like. They come out of their houses and eat and eat. They are very hungry after the long winter.

7. Some Animals Store Away Food for Winter

Chipmunks are very busy little animals.

"Chip, chip, chip," they say as they hurry about.

During the fall days they are very busy indeed. They are getting ready for winter.

They hunt for nuts, acorns, seeds, and berries. Chipmunks have little pockets in their cheeks. These open into their mouths. Their food is carried in these pockets.

They often hide away their food for a short time under walks and trees. Later on they move it to their burrows.

This food will be ready for the hungry little chipmunks to eat between their long winter naps.

Squirrels, too, are very busy during the fall days. They store away nuts, seeds, and grains for the winter. Their

faces are puffed out as if they had the mumps. Their cheek pockets are full of next winter's food.

They hide away their food in trees. They hide it in the ground at the foot of trees. They hide it where they can find it on cold winter days.

Squirrels, too, have long naps in the winter time. They curl up in some funny places. They sleep in people's attics or in bird houses. They take naps under roots or in holes in the trunks of trees.

When the squirrels are not sleeping, they are very busy. They do not always use the food which they have put away so carefully. Sometimes they cannot find it. Sometimes another squirrel finds it and eats it. Sometimes

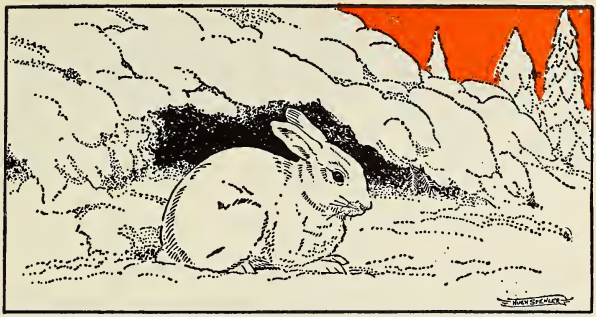
they do not bother to look for it. They look for other food instead.

They find nuts. They eat seeds from weeds or bushes which stick out of the snow. They steal the farmer's grain, fruits, and vegetables. They know how to get seeds out of pine cones.

Red squirrels are very fond of the cones of evergreen trees. They like them so much that they live near those trees. You can often find their tunnels in the snow around these trees.

8. Some Animals Hunt for Their Food All Winter

Some animals have little to help them when the cold winter comes. They do not make warm, safe houses for themselves. They do not hide away



food. They do not go to sleep for the winter. They travel about to find food where they can. Their thick winter coat of fur keeps them warm.

Rabbits have strange resting places in the winter time. They squat down in a comfortable spot, as in the picture. This is often near a stone or a stump. Sometimes it is in the corner of a fence. Sometimes it is under a low bush or tree. The snowflakes often cover them, but they do not seem to mind.

When their nap is over, they crawl out of their snowy nests to look for food. They eat the dead grass, winter buds, and the bark of trees. They sometimes spoil farmers' orchards by eating the bark of young trees.

Rabbits have many enemies in winter. Many animals would like to have them for food if they could. But rabbits are careful to keep away from their enemies. Some rabbits can see all around from their strange open nest. When they are covered with snow their enemies cannot see them easily. In cold places some rabbits change their color. Their fur turns white like the snow. Then their enemies have a very hard time to find them.

Deer do not need to make homes for themselves. They do not store away food in winter. They travel all around and seem to find plenty to eat.

They like to eat the small branches of trees and bushes. They eat the bark of trees. They eat the moss which grows like a carpet over the ground and around the roots of trees. They push away the snow with their hoofs. Sometimes they find grass underneath the snow.

Deer have different ways of living in the snow. Some deer make paths in the woods. Through these paths they can reach their bushes, trees, or moss. During a storm they keep walking up and down the paths so that the snow will not fill them.

Other deer push away the snow from a wide, round place like a floor. They push it away with their hoofs. The grass and mosses are ready for them to eat. This ground looks much as it does in summer.

Wolves do not often put away food for winter. They run about killing other animals for food. They are so strong that they can kill and eat almost any animal they wish.

They will eat mice, rabbits, squirrels, deer, cows, and many other animals. When they cannot get meat, they will dig up some kinds of roots for food.

Things to Think About

1. Do you think that one of these animals takes better care of himself than the rest do? Does the chipmunk take better care of himself than the deer does? Does the muskrat take better care of himself than the turtle?

2. A chipmunk cannot run about through the snowy woods. He cannot push away snow to find food.

3. A deer cannot spend the winter in a tunnel under the ground.

4. Each animal cares for himself in a way that is best for him.

UNIT II

Learning about Plants

I · THE PARTS OF A PLANT

1. Watching Plants Grow

The children in Miss Gordon's class had a beautiful window garden. On the window sill were geraniums and other house plants.

Some bowls held stones and water. Narcissus bulbs were planted in these bowls. A hyacinth bulb was growing in a tall vase of water.

The children said, "The bulbs look like onions."

Miss Gordon said: "Onions are bulbs. Let's plant an onion." So they did.

In a window box the children planted seeds. They planted radish seeds, lettuce seeds, and beans. They planted sweet peas and nasturtiums.

In another box they planted tulip bulbs and crocus bulbs. They put this box in a dark cupboard. These bulbs would begin to grow late in the winter. They planned to put the box back into the light again in February or March.

The children took good care of their window garden. They gave their plants plenty of water. They watered the bulbs which were in the dark.

The seeds in the window box grew very fast. The children liked to watch for leaves and stems and new buds. By and by they could tell which plants were the lettuce plants. They could tell

which were the radish plants, and which were the bean plants.

One day Miss Gordon put up a sign. The sign looked like this:

Do you Know the Parts of a Plant?

Do you know —

What part is the root?

What part is the stem?

What part is the leaf?

Where the buds are?

What the buds hold?

Can you answer these questions?

Here are some of the answers which the children found. The growing plants helped them to find good answers.

2. What Part is the Root?

The root of the plant is under the ground.

The roots hold the plant in the ground.

Pull a plant up by the roots. Notice the ground which is still hanging to its roots. These tiny root hairs twist around through the ground. They seem to tie the plant in the ground.

The roots draw water from the ground for the plant. Plants must have water in order to live.

3. What Part is the Stem?

The stem of the plant is the part where the leaves are fastened.

There are all kinds of stems.

There are stiff, strong stems like the stems of the geranium.

There are long, curly stems like the stems of the bean and sweet-pea vines.

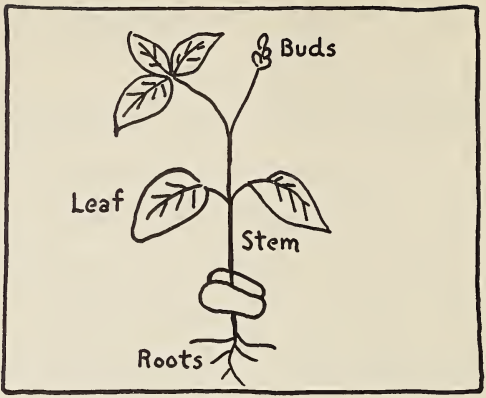
There are thin stems which break easily like the stems of the nasturtium.

There are short, thick stems. Can you find the stem of the lettuce plant? It is inside the head of lettuce. It is called the "heart."

Bulbs are stems. They are not roots. You will read more about this on page 86.

4. What Part is the Leaf?

There were too many bean vines. Mary pulled one up. She looked at the dirt on its roots. Then she drew its picture. Here it is.



Look at Mary's picture and see where the leaves and buds are.

5. What do the Buds Hold?

Some buds hold leaves. Some buds hold flowers. Some buds hold both leaves and flowers.

Winter buds on trees and bushes hold food for the plant to live on during the winter. Page 89 tells you more about this.

1. What Part of Plants Do We Eat?

One day Miss Gordon put up another sign. This sign read:

What Part of Plants Do We Eat?

Mark the right answer—

seeds	roots	stems
leaves	flowers	buds

Some children marked "seeds." Some children marked "leaves." Some marked "roots."

When the class met to talk about the sign, each answer had been written many times.

"Which answer is right?" asked the children.

"All the answers are right," said Miss Gordon. "We eat the seeds of some plants. We eat the leaves of other plants. We eat the roots. We eat stems. We eat the flowers and buds of a few plants."

"Let's name some seeds which we eat," said the children. "Let's make a long list of all the parts."

Miss Gordon wrote these lists on the board.

Seeds which we eat

beans peas corn

Flour is made from the seeds of wheat, rye, and barley.

Stems which we eat

celery potatoes onions

Potatoes are stems which grow under the ground. Onions are bulbs. Bulbs are stems.

Roots which we eat

carrots	beets
radishes	turnips

Leaves which we eat

lettuce	spinach	dandelion
cabbage	Swiss chard	beet

Flowers and buds which we eat

Cauliflower is the flower of the plant. We eat the buds of the asparagus.

"Miss Gordon is right," said the children. "We eat all parts of plants."

"We could not live without plants," replied Miss Gordon. "We must have them for food."

Things to Do

Did you ever hear of a vegetable garden in a saucer?

1. Cut off a piece of a carrot, a beet, or a turnip. Cut your piece from the top of the vegetable. Cut pieces from the tops of two or three vegetables.

2. Stand your vegetables in a saucer. Keep a little water in the saucer. Keep your saucer in the sun.

3. By and by little new leaves will grow out from the top of the vegetables. They will be a light, pretty green. They will be smaller than the leaves which grew on the vegetables when they were in the ground.

4. Can you tell what makes these leaves grow from the vegetables when you keep them in water?

III · HOW PLANTS LIVE THROUGH THE WINTER

1. Storing Food

What happens to plants when cold winter comes? Plants need food to keep them alive.

People store away food so that they can have plenty to eat in the winter. Plants have plenty of food in the winter because they too have food stored away. Where should you look to find the food which plants store away for the winter?

There are three places for plants to store their food. Some plants store their food in their roots. Some plants store their food in the stem. Some plants store their food in their buds.

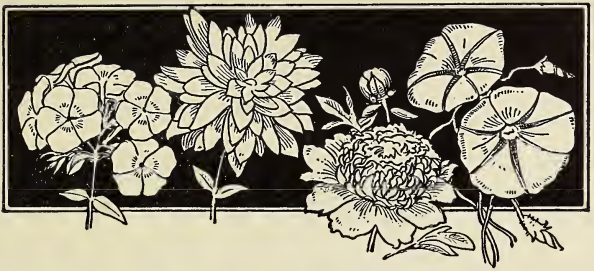
This food keeps them alive during the winter.

2. Root Storehouses

In the late fall and winter the grass looks dry and dead. But underneath the ground the roots are still alive. They are holding food and water. When spring comes new grass will come up through the ground from these roots.

Have you seen weeds growing by the fence or by the side of the road? How do they get there? Surely no one plants them. Many weeds grow from year to year because their roots stay alive underneath the ground.

Here are pictures of some garden flowers. What beautiful colors they have in summer — pink, yellow, red, or



blue. In the winter the part above the ground is dry, brown, and dead. But their roots are not dead. They are holding food all through the winter. In the spring new stems and leaves begin to grow. The plants use the food which has been stored away in their roots all winter.

Carrots, beets, radishes, and turnips hold much plant food in their roots. They hold so much food that people like to eat them. The plant food becomes food for people.

3. Stem Storehouses

The children were excited when their bulbs began to grow. The leaves seemed to grow out of the roots. The bulb part seemed like a root. They put the whole bulb under the ground when they planted them in the earth.

"But the bulb is the stem of the plant," said Miss Gordon. "Let us look at our onion. Do you see the little strings, or fibers, on the under part? These are the roots. The large round part which we eat is the stem."

The children watched the bulbs which they had planted in water. Long strings, or fibers, began to grow from the under part of the bulb. These were the roots.

The roots grew longer and longer.

They fastened themselves around the stones in the dish. These roots did not hold food for plants. The food was in the bulb, or stem.

As the roots grew from the under side of the bulb, green leaves pushed their way through the top of the bulb. The roots grew longer and longer. The leaves grew larger and larger. A flower bud grew out from the bulb. Its blossoms were white and beautiful. It had a sweet, sweet smell.

As the leaves, flowers, and roots grew larger, the bulb part of the plant grew soft and empty. The children felt it with their fingers. Mary said, "It feels like a stem now."

Do you know what made the bulb part soft and empty? The food had

gone out of the fat, round, hard part. The leaves, flowers, and roots had used this food to make them grow.

By and by the flowers faded. The leaves grew brown and dry. "They have no more food to make them grow," Bill told the children.

"If we cut off the tops," said Miss Gordon, "then the plant will begin to store away food in the stem."

The children cut off the leaves and the faded flower. They did the same thing when their tulips and crocus plants had faded. The bulb part began to store away food again. Inside was a baby plant which would need this food another year.

Cut a bulb in halves as you see it on the next page. Can you see the begin-

ning leaves in the center of the bulb? Can you see the food which will be used for leaves, roots, and blossoms?

4. Bud Storehouses

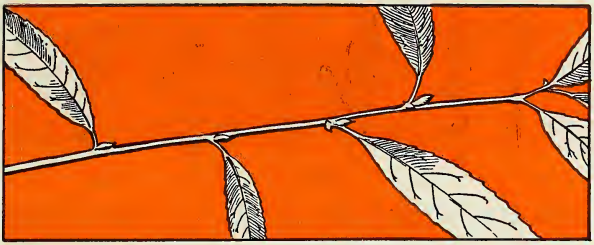
Trees are our largest kind of plants. Their food is stored in a very tiny storehouse. The food of trees is stored in the buds. Can you tell how such a tiny storehouse can hold enough food for such a large plant?

Look at the branches of a tree in winter. Can you count all the buds? Can you count all the buds which are on one branch? There are hundreds of buds on every tree. So many buds can hold a great deal of food for a plant.

The food of bushes is stored in the buds too. Rosebushes, blackberry bushes, raspberry, and many other bushes store their food in the buds.

Trees and bushes do most of their growing in the early summer. At this time the buds grow larger. Leaves grow from the buds. The branches and stems become larger and larger too.

When the long, hot, dusty days of the middle of summer come, the trees and bushes do less growing. They begin to store away food for the next winter.



New buds begin to grow where the leaf is fastened to the branch. At first the bud is very tiny. You can hardly see it by the stem of the leaf. It grows and grows. In the fall the leaves drop off. Then you see the bud quite plainly.

Do you wonder why the little new buds do not freeze to death in winter? Some buds are covered with hard scales. Some are covered with sticky gum, and some with hairs. These little coats keep the bud from freezing to death during the cold days of winter.

In the spring the buds become larger and larger. Soon the leaves show. When the leaves come out, the tree or bush begins to grow again. New twigs grow out on the branches. The branches grow larger. The plant grows and grows until the late summer days come again. Then the plant stops using its food to make itself grow. It begins to store food away in its buds again.

Things to Do

1. Very carefully open a leaf-bud to see the tiny leaf that is folded up inside. When you have looked at the

little leaf, try to fold it up again as it was before. Can you do it?

2. Early in the spring when the buds are tight shut, bring some branches inside and put them in a vase of water. If you keep them in a warm place in the sunshine, the buds will open. You will like to watch the tightly folded buds open. You will like to see their pretty colors.

3. It is fun to watch the buds at different times of the year. Choose a branch of a tree or bush. Tie something on it so that you will always know which is your branch. You must study the same branch each time.

4. Look at the branch in summer. See how tiny the buds are where the leaf is fastened to the branch.

5. Look at the buds in the fall when

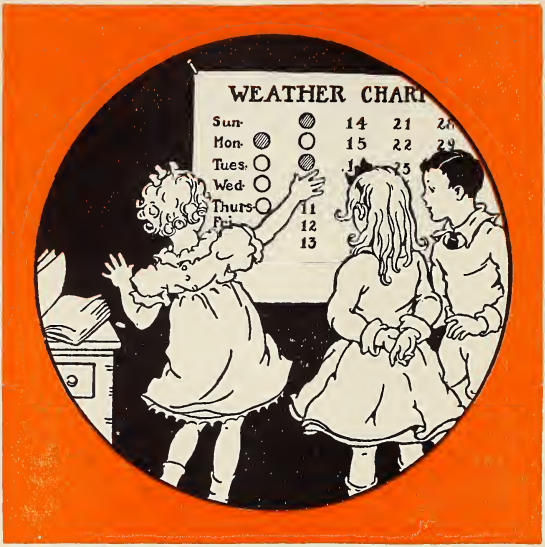
the leaves are coming down. How much they have grown!

6. Look at the buds in winter. Do you see their winter coats?

7. Watch them in spring. How large they are! They are ready to open into leaves or blossoms.

UNIT III

The Story of the Weather


WEATHER CHART
Sun
Mon
Tues
Wed
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22

I · ALL KINDS OF WEATHER

How many different kinds of weather can you name? Help your teacher to make a list of these on the blackboard.

Have you ever been sorry because the weather was not the way you wanted it to be? Picnics are often spoiled by rainy days.

Tell how the weather helped you to do something you wanted to do very much.

1. Our Weather Needs

The children in Miss Gordon's room made a big calendar. On each day of the week they pasted a colored paper which showed what the weather had been that day. Yellow showed the days that had been sunny. Blue was for cloudy days. Gray was for rainy days. White was for snowy days.

Some months there were many gray spots on the calendar. Most of the children did not like so many rainy days.

But Miss Gordon said: "We need the rainy days. The farmers like them because they help to make their grain and vegetables grow. Everybody has to use the farmer's grain and vegetables. We must have a great deal of rain to fill the reservoirs which hold the water that city people use. We must have a great deal of rain to fill the wells and springs for people who live on farms. Much rain is needed to keep plenty of water in the rivers and lakes."

Bob said: "But if it rains all the time, there will be too much water. Sometimes rivers and lakes get too full of water and then we have floods."

"Yes, that is true," said Miss Gordon. "Sometimes there is so much rain that the farmer's crops are spoiled. Sometimes the young plants are washed out of the ground. Sometimes the older plants become soft and will not grow."

"Sometimes floods flow into towns and cities. The streets are full of water," said Mary.

"Floods do a great deal of harm," said Miss Gordon.

Bill said: "But you can have too much sunny weather too. Sometimes the rain stays away for such a long time that the farmer's crops dry up."

Rachel said: "Their wells become dry too. Then they do not have good water to drink."

Miss Gordon said: "That is true, too.

We need all kinds of weather. We need the rainy days and the sunny days. We need cool days and hot days."

2. Fog

One morning there was a fog. The children were on their way to school. The air was not clear and bright. The children could not see very far down the street. They could not see the school building until they were close to it.

"The fog is very damp," said Mary. "My face feels wet. It isn't raining; so it must be the fog."

"The walks are damp," said Bill.

"I wonder if the trees are wet," said Bob. He felt a tree. It was quite damp. Everything the children touched seemed damp and sticky.

"What is fog?" Mary asked, as she held out her hand. "Is it smoke?"

"No, it isn't smoke," said Bill. "It looks like smoke, but nothing is burning."

"Well, what is it, then?" Mary asked again.

Jane said: "I know what fog is. Fog is a cloud. That is why everything it touches feels so damp and sticky."

"How could fog be a cloud?" asked Bill. "Clouds are up in the sky."

When they reached school, they asked Miss Gordon about fog. She said: "Jane is right. Fog is a cloud. It is a cloud which is made right here around us. It is the same as the clouds which are high in the sky."

People must watch very carefully when they travel in a fog. Boats cannot see each other well in a fog. They bump into each other very easily. The foghorns blow and blow. They seem to say:

"My boat is here.
Don't come too near."

Why must people drive their automobiles very carefully in a fog?

Why do trains often run slowly in a fog?

Airplanes must be very careful in a fog, too.

3. Snow

"What good are snowy days except to have fun?" asked Rachel.

Bill said: "The snow makes a blanket to keep the plants warm in winter. My mother says that many plants freeze in winter when the snow does not cover them. She says they are winter-killed."

The blanket of snow makes a warm cover for the earth. Did you ever crawl into a pile of new, soft snow for a minute? Were you warm under the

snow? Was it warmer under the snow than it was in the outside air?

Eskimos keep warm and comfortable inside their snow houses. The snow keeps out the cold wind and keeps in the heat made by their oil lamp.

Some animals lie close to the ground and let the snow fall over them. You can read about these on page 64. They often sleep while the snow covers them. They are comfortable and warm in their snowy beds.

Snow has other uses too. When snow melts, the water runs into the ground. The ground needs this water. Lakes and rivers also need the melting snow.

4. Ice

The children put a pan of water out-of-doors on the window sill. They wanted to see what happens to water while it is freezing. This is what happened.

At first there was a sheet of ice as thin as paper on top of the water.

It broke when the children touched it with their fingers. The sheet of ice slowly became thicker. It always stayed at the top of the water. The water at the bottom of the pan froze last of all.

Ice always forms at the top of water. Ice is lighter than water. It floats. So we always find it at the top, first of all.

Put some pieces of ice in a dish of water. In what part of the water do they stay? Stir them around. Do they drop to the bottom? Push them down to the bottom of the dish. Do they stay there?

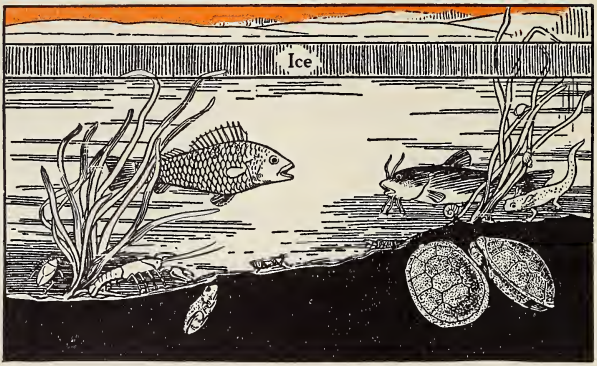
Miss Gordon asked the children, "Do you think the top of the water is the best place for the ice to form?"

The children thought about this question for a while. Then Bob said: "Yes, I do. If the ice did not form at the top of the water, we could not go ice skating. We couldn't skate on the bottom of the pond very well."

Mary said: "I think the top is the best place for ice to form. Sometimes people have to travel over the ice in the winter. Horses pull loads on big sleds. People often drive automobiles across the ice where there is no bridge."

Miss Gordon said: "Yes, those are both good reasons. But there is one reason better than either of these. See if you can find out what it is."

After a while Mary found a picture of an Eskimo fishing through a hole in the ice. She showed the picture to



Rachel. She said, "The fish must live in water under the ice."

Rachel said: "Our goldfish are still in the pond in the yard. They must be in water underneath the ice."

They asked Miss Gordon if deep rivers and lakes ever froze all the way to the bottom. Miss Gordon said, "No, some water is left where the fish can stay."

Bill said: "Frogs and turtles crawl

into the mud so they are safe. But they might freeze if the ice lay next to them on the bottom of the water."

The children believed that the fish, turtles, and frogs are much better off with the ice at the top of the water.

"That was my best reason," said Miss Gordon. "The water animals would have a hard time if there were no place for them below the ice."

Things to Think About

1. Solid ice and liquid water are quite different in many ways. Tell as many of these ways as you can.

2. What can you do with water that you cannot do with ice?

3. What can you do with ice that you cannot do with water?

Things to Do

1. Tell how a snowstorm is different from a rainstorm. Tell how each storm sounds. Tell how each storm looks. Tell how the world looks after each storm is over.

2. Let some snowflakes fall on a piece of dark cloth. See how beautiful they are. Can you find two that are just alike?

II · KNOWING HOW WARM IT IS

1. When to Wear Warm Clothes

It was hard to tell which kind of weather the children liked best. It was fun to come to school in the rain. They wore raincoats and rubbers. They carried umbrellas. They could keep dry when they were dressed for rain. They did not mind the big drops which fell all around them.

They liked snowy days too. What fun it was to play in the snow! What fun it was to build snow forts and snow men! The children did not mind the cold weather because they were dressed warmly.

When they came to school in winter, they wore warm coats and mittens.

They wore warm underwear. The cold winter winds could not hurt them. When they went out-of-doors to play at recess time, they were sure to put on all their warm wraps. They enjoyed their playtime because they were comfortable and warm.

One fall day looked very sunny and bright. The days had been quite warm. But this day was cold, even if the sun was shining. Mary and Bill wore no coats to school. They had on their thin sweaters. When they reached the school they were very cold. At recess time they shivered. They could not keep warm when they played.

"Why didn't you wear warm coats?" the children asked them. "Didn't you know it was cold when you left home?"

"Yes," Bill said, "but we didn't want to bother to go back."

Did you ever do a foolish thing like that? Did it give you a bad cold?

Bill and Mary had very bad colds and had to stay in bed. The children at school wrote letters to them.

When Bill and Mary answered, they said, "It is better to bother to go back and get your coat than to bother to have a bad cold."

Their mother said: "You should have bothered to come back. I could not tell you to put on warm coats. I did not know how cold it was. I had not been out-of-doors. But you are big enough to take care of yourselves now."

Then she made them a present. She gave them a thermometer.

The thermometer was hung on the outside of the house beside the front door. Mrs. Brown told Bill and Mary to read the thermometer every morning. Then she told them what clothes to wear when the weather was very cold. She told them what clothes to wear when the weather was warm.

"Now," said Mrs. Brown, "you can take care of yourselves."

2. About Thermometers

Could the thermometer tell you when to wear your warmest clothes? Could it tell you when it would be safe to wear your cooler ones? Do you know what the numbers on the thermometer mean?

The little mark like this ° is called a degree. When we see 68° we read it this way: "68 degrees." When we see 32° we read it "32 degrees." When we see the mark 0° we read it "zero."

We measure heat by degrees as we measure milk by the pint or quart.

A large number, such as 68°, means that the air is warm. A small number, such as 32°, means that the air is cold.

Very hot: Wear as few clothes as you like.

Very warm: Wear very thin clothes.

Warm: A schoolroom should be kept 68°.

Very cool: Wear a warm coat and a hat.

Water will freeze: Wear a very warm coat, hat, mittens, and leggings.

Very cold: Wear plenty of very warm clothes.

Very, very cold: Look out for your nose! Wear the warmest clothes you have.

Here are Some of the Most Important Numbers for Children

The shiny liquid that you see in the glass is called mercury. Heat makes the mercury climb up, up. Cold makes it drop down toward the bottom.

Thermometers work the same way all over the world.

On page 20 is a picture of a hot country where it is summer all the year. People wear almost no clothes at all. Should you look at the top or the bottom of the thermometer to find out how hot the weather is there?

On page 18 is a picture of some Eskimos. They are playing near a snow house. Should you look at the top or the bottom of the thermometer to find out how cold it is there?

Tell some of the places where you have seen thermometers.

Do you read the thermometer in your schoolroom? Does the mercury stay in the same spot most of the time? Should the mercury in an indoor thermometer keep climbing up and down? Why not?

Have you a thermometer in your house? We need thermometers almost as much as we need clothes. We want to be sure that our houses are warm enough or cool enough.

Has the doctor ever put a thermometer into your mouth? If you have a fever, the thermometer tells the doctor. If the mercury in the thermometer rises above 98.6°, you must go to bed, for you are sick.

Things to Do

1. Make a picture of a windy, rainy day. How can you show that the wind is blowing? How will the people hold their umbrellas? How will they be dressed?

2. Make a picture of a snowy day. The ground will be covered with snow. What other places will be covered with snow?

3. Make a picture of a snowflake. Make it large enough so that all the children can see every part of it.

4. Above is a picture of Jack's weather vane. It always told him which way the wind was blowing, because the propeller always pointed that way. N is for north. S is for south. What are the other letters for?

III · ABOUT THE AIR

1. Air is Always around Us

The children in Miss Gordon's room had great fun learning about the weather. They learned a very important thing about air itself. They learned that air is all about us. We cannot go away from the air.

Air is everywhere around us. Air fills our schoolrooms. Air is in our homes. Air fills all the out-of-doors. Wherever we go we find air.

Air is around us at all times. We must have air in the winter and in the summer. We need the air in the spring and in the fall. The air is around us through the night and through the day. We could not live without air.

2. We Must Have Air to Breathe

Press your handkerchief over your nose and mouth for a few minutes. Could you breathe well? Now press so hard that you cannot breathe at all. Did you feel very comfortable?

Do you know why you do not feel comfortable when you cannot breathe? It is because you have taken air away from yourself. We must have air to breathe.

One day Bill said, "I wonder what air is made of."

Rachel said, "Well, I don't know what air is made of, but I know two things which are always in the air."

"What two things are always in the air?" asked the children.

Rachel answered, "My mother said that water and dust are always in the air."

3. Water in the Air

Miss Gordon said: "Do you remember the day we made apple sauce? Do you remember how the water boiled away? We had to watch it very carefully."

"Yes," said the children. "We had to watch it to keep it from burning."

"Where did the water go?" asked Miss Gordon.

"Into the air," said the children.

"Did you see it?" asked Miss Gordon.

"Not exactly," said Rachel. "But only a little of the water was left when we stopped boiling the apple sauce. The

rest of the water must have gone somewhere. It must have gone into the air."

"You did see some of the water in the air," said Miss Gordon. "Do you remember the puffy little cloud which seemed to stay near the cover of the pan? That cloud was the steam which had turned back into water. It stayed as water for a minute. Then it hid itself in the air."

Bill said, "The steam from an engine on a train goes into the air, too."

"Yes," said Miss Gordon. "Water goes into the air from many other places too. When you hang up your wet bathing suit to dry, where does the water go?"

The children told about many other places which give water to the air.

"When the wet pavements dry, the water goes into the air," said Rachel.

"The air takes the dew from the grass early in the morning," said Bill.

The air takes the water out of the paste when we leave the cover off the jar.

Can you tell about other places which send water into the air?

4. Dust in the Air

Do you ever wonder why a house needs to be dusted every day? Does some one come around at night and sprinkle dust over chairs, tables, and books?

The Brown family had been away all summer. When they came home, the house needed to be cleaned. Dust was everywhere! The children could write their names in the dust on the tables. Their shoes left marks on the floor.

"How did the house get so dusty? No one has lived here all summer," Mary said.

Mrs. Brown said: "Dust is everywhere. You can't keep dust out of

places unless they are shut so tight that air cannot get in. Dust is in the air."

This is very true. Did you ever look for something in a drawer which had not been opened for a long, long time? Did you find dust on the things in the drawer? How do you suppose the dust got into the drawer? Remember that the drawer had been tight shut for a long, long time. Air was in the drawer. Everywhere the air goes, the dust goes too.

Sometimes this happens at your house. Your mother takes a coat out of a closet. She looks at it carefully. Then she says: "My! this coat is dusty. It has been hanging in the closet a long, long time."

She brushes it hard before she hangs it away again. Can you explain how the dust could get into the closet?

Dust is in the air. In dry weather it covers everything out-of-doors. Trees, flowers, bushes, and grass get very dusty sometimes. Their leaves become covered with dust. They are not so green as they were. They become very dry. They need to have a rain bath once in a while.

Mr. and Mrs. Brown and Mary were standing on a high hill. They wanted to see the beautiful view far, far away.

"On clear days we can see the city," said Mr. Brown, "but we cannot see the city today."

"Why not?" asked Mary.

"There is too much dust in the air today," her father said.

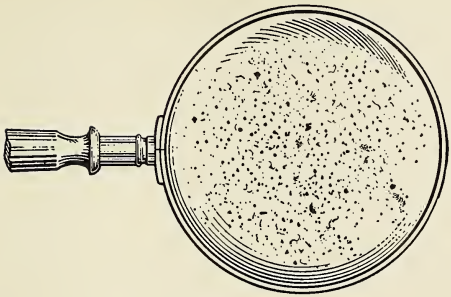
"There is a great deal of water in the air, too," said Mrs. Brown. "I think it will rain before morning."

Mary said, "A gray curtain seems to be covering our picture."

"Yes, it is like a gray curtain of water and dust," said her mother.

That night the rain fell hard. The next day was cool, clear, and shiny. The rain had washed the dust out of the air.

How green the trees and grass were! What bright colors the flowers wore! Mary could see cows and fences on the hills. She had not been able to see them before the rain. She could see the city, far, far away.



Things to Think About

Do you know what the spots are in this picture? They are grains of the dust which is in the air. This is the way dust in the air looks when its grains are made larger in a picture.

UNIT IV

The Sky above Us

1. The Sun Lights the Earth

Mary and Jane sleep in a room which has the earliest light of day. The sun peeps through their window as soon as day is here. Mary and Jane often wake up early enough to see the sun rise.

Did you ever see the sun rise? How did it look? Isn't it beautiful? Did the earth grow light all at once?

You must be awake very, very early in the morning to see the sun rise. As soon as the sun begins to show itself, the earth begins to grow light. When the earth is light, day is here.

The sun is high over our heads at

noon. Then the earth is very light. The lightest hours of the day come when the sun is high up in the sky. When the sun is high up in the sky at noon, shadows are very short. In summer the bright noon sunlight often makes you hot and uncomfortable. If you wish to keep out of the bright noon sunlight, you stay in the house.

Late in the afternoon the sun begins to go down. The shadows grow very long. There are many shady places in which to play. But now you can be comfortable in the sun. The sunlight is not so hot as it was at noon. When the sun begins to go down, the day is not so bright.

When the sun has set, day is done. The earth is dark, and night is here. In other parts of the earth people are having day, but we are having night.

Wherever the sun lights the earth, there is day. Wherever the sun does not light the earth, there is night. Without the sun we could not have day. Without the sun it would be night all the time.

Mary and Bill were looking at the

night sky. Bright stars were shining. The round moon was shining, too.

"How light the world is tonight," said Mary.

"You can see the shadows of the trees," Bill said.

"Yes," said their mother, "the world is often very bright at night. But there is always more light in the daytime."

Bill and Mary remembered what they had done that morning. They had stayed indoors because it was so dark and rainy outside. They sat by the window and read their storybooks.

"Even a cloudy day is lighter than the night-time," said Bill. "We cannot read our storybooks by the light of the moon."

The sun gives the earth most of its

light. The sun is always shining on some part of the earth. Clouds often come between us and the sun. Yet the sun goes on lighting the earth. Sometimes the clouds are thick and dark. But away above the clouds the sun keeps on shining. It never, never stops shining.

2. The Sun Heats the Earth

The sun heats the earth. Without the sun the earth would be freezing cold everywhere.

We could not live without the sun. The earth would be so cold that the plants would die. It would be so cold that the animals would die. Even people would freeze if the sun did not shine on the earth.

Tell about the hottest day you can remember.

Tell about the coldest day you can remember.

The sun makes the earth warmer in the summer than it does in the winter. In the summer it is often too warm for you to play in the sun. You stay in the shade to be comfortable. In the winter it is quite the other way. You often play in the sun in order to keep warm. The shady places are too cold to be comfortable.

Do you know why the earth is warmer in summer than it is in winter? Here is one reason.

The days are longer in the summer than they are in the winter. There are

more hours of sunlight for the earth to grow warm.

There are more hours for the sun to shine on the lakes and oceans and make them warm. There are more hours for the sun to shine on the mountains and meadows and make them warm. There are more hours for the air to get warm.

It is always warmer where the sun is shining. Daytime is warmer than night. The sun heats the earth. Even in the winter the sun heats the earth. No one could live on the earth in the winter if the sun did not give us heat.

Mary and Bill live near two hills. In the winter the children have great fun sliding down these hills on their sleds.

On one hill the sun shines nearly all day. The sun does not shine on the other hill until late in the afternoon. On one hill much of the snow melts away. On the other hill there is always plenty of snow.

Which hill keeps the snow longer—the hill in the sun or the hill in the shade?

Does this show you that the sun does warm the earth, even in winter?

3. About the Moon

Jane and Mary and Bill liked to watch the sky at night. They liked to see the bright, shiny stars. Best of all, they liked to look at the moon.

"The moon looks a little different every night," said Jane. "For a while it

seems a little larger every night. Then it seems a little smaller every night."

"The moon rises at different times too," said Bill.

"Yes," Mary said, "sometimes you can see it before we have supper. Sometimes it rises just before we go to bed."

"Sometimes it rises long after we have gone to sleep," said Jane. "One night I looked for the moon, and it was not shining at all. I looked just before I climbed into bed. A long time afterwards Mother came into the room to put a blanket over us. The moon was rising then. I could see it just coming up behind the hill. In a little while it began to shine into the room."

"It was nearly twelve o'clock, Jane," said their mother. "The moon was very late in rising that night. The moon rises a little later and a little later every night."

Then she said: "On some nights we have no moon at all. Only the stars are shining in the sky."

Bill said: "I have seen the moon in

the daytime. It looked like a tiny cloud, but I knew it was the moon."

"I saw the moon one morning," said Jane. "It was white like a cloud, but it did not look like a cloud. I knew it was the moon."

"I think I saw the moon one afternoon," Mary said. "It looked like the moon. It seemed like a cloud. I didn't know that the moon could be seen in the daytime."

Did you ever see the moon in the daytime? Did it look the way it looks at night? How did you know it was the moon?

Do you know what Jane meant when she said, "The moon looks a little

different every night"? Here are some pictures which show what she meant. Have you seen the moon when it looked as it does in these pictures?

Of course you know that the moon itself does not change at all. The change is in the part we can see. Sometimes we can see a large part of the moon. Sometimes we can see only a small part.

4. The Sun and the Moon and the Stars

The sun gives the earth its greatest light. It gives the earth more light than all the stars together. The sun gives the moon its light.

We can watch the moon very easily. Did you ever try it?

Tell about some of the things you saw when you watched the moon.

You can watch the sun too. You must be very careful when you do so. Always use a piece of dark glass. The bright sun will hurt your eyes if you do not use a dark glass. You can see wonderful things when you look at the sun.

The stars seem to be only tiny points of light. Yet they are great suns, as large as our sun is.

We can see the sun and the moon more clearly than we can see the stars. The sun and the moon are much closer to us than the stars are. The moon is much closer to us than the sun is.

But the moon and the sun are far, far away from the earth. The moon is miles and miles away. The sun is miles and miles and miles farther away than the moon is. The stars are too far away for most of us to understand how many, many miles away they are.

5. Plants, Animals, and People Need the Sun

Do you ever wonder—

1. Why people plant their gardens in sunny places?

2. Why you put plants in the window instead of in the darkest corner of the room?

3. Why you put your bulbs in the sunniest window to make them grow fast?

Try these two ways of planting. Put seeds in two jars of good dirt. Place one jar in a sunny window. Place the other jar in the darkest corner of the room.

Which plants grow faster? Which plants have more leaves? Which plants have larger leaves? Which leaves have longer stems? Can you tell what makes the stems so long?

Try the same plan with two bowls of bulbs. Which bulbs have flowers first? Which flowers are prettier? Which bulbs have longer leaves? Why are the leaves so long?

Plants need sunlight. They must have plenty of sunlight to grow into strong healthy plants.

People need sunlight, too. Sick people often sit in the sun so that they can get well fast.

Children must have plenty of sunlight. It helps to make their bones hard and strong.

Most of all, babies need sunlight. Their bones do not grow well without it.

Animals need sunlight, too. It keeps them strong and healthy.

Every living thing needs the sunlight — plants, animals, and people. We could not live without it.

Things to Think About

1. What are some of the things you can do in the daytime which you cannot do at night?

2. Can you tell why you can do some things in the daytime that you cannot do at night?

Things to Do

1. Here is something that is fun to try on a hot day.

Fill two pans with water. Keep one pan in the hot sun. Keep the other pan in the shade. At the end of two hours

put your fingers in the water. In which pan is the water warmer? Is it very much warmer? If you have a thermometer, you can tell exactly how much warmer it is.

If you leave your pans of water outside, the birds may come to drink and to take a bath. Which pan of water do you think the birds will like better? Why?

Put a piece of ice in a pan. Keep the pan in the sun. How long does it take for the ice to melt? How long does it take for the ice-water to become warm water?

2. Here is something that is fun to do on a freezing cold day.

Fill two pans with water. Keep one pan in a sunny place. Keep the other pan in the shade. In which pan does the water freeze first? Can you tell why?

UNIT V

The Story of the Ground

I · HOW SOIL IS MADE

Do you know what soil is?

Nearly every part of the earth is covered with a blanket of soil.

When we take walks in the country, we find soil in the paths or in the dusty road. Grass grows in soil. The woods grow in soil. Gardens grow in soil.

City pavements are made on top of the soil. Houses, stores, and most big buildings are built on top of the soil.

Soil is found at the bottom of rivers. Even the bottom of the ocean is made of soil.

In some places great rocks poke their heads up through this blanket of soil. In some places there are so many rocks that there is little soil. But most places of the earth are covered with this blanket of soil.

1. Kinds of Soil

Jane and Mary knew about different kinds of soil. They knew about the brown soil in which flowers and vegetables grew in the garden. They knew

about the black soil in the woods. They knew about the sand where they liked to play on the seashore. They knew about the clay which they used in school. Did you know that clay is soil?

Jane and Mary liked to mold the clay. They molded bowls of clay. They molded bears, horses, and even people out of clay. They liked the feel of the clay in their hands. It was smooth. The grains were very small and fine. The things they made out of clay held together. They did not fall apart.

Jane and Mary liked to build houses of sand. They could not make sand bowls and sand bears. The grains of sand would not hold together. The grains of sand were large, coarse, and shiny.

The girls did not often play in the garden soil. Sometimes they made mud pies, but this made their hands and dresses dirty.

They learned something about garden soil which is interesting. The mud pies held together better than sand houses did. The mud pies fell apart more easily than the clay bowls did. The grains of garden soil are finer than grains of sand. They are coarser than grains of clay.

Do you ever wonder what makes this soil which covers the earth?

Most of the soil of the earth comes from the rocks. Does this seem quite strange? Some rocks are very hard. You can hardly break them even with a hammer. Soil is quite different. You can smash soil into tiny specks or grains

by squeezing it in your hands. Yet soil comes from the rocks.

What do you suppose is strong enough to grind the hard rocks into fine grains of soil?

Water and wind are always working away at the rocks. They help to rub them, grind them, crack them, pound them, push them, and break them. Water and wind have really made the soil for our earth.

The sun, too, has helped to make soil.

2. How Water Turns the Rocks into Soil

Have you ever made a collection of stones or pebbles by keeping all the interesting pebbles you find? Sometimes you choose pretty colors. Jane

and Mary like to look for pretty stones by the seashore. They kept some pebbles in their collection because they had a pretty color. They kept other pebbles because they were so round and smooth. Other pebbles were full of holes.

Jane and Mary wondered how their stones came to be so smooth and round. Their mother said: "Watch the stones when the waves roll over them. They rub against each other so much that they become smoothed and polished."

"Just as wood becomes smooth when you rub it with a piece of rough sandpaper," said Jane.

Her mother said: "Yes. And here is another strange thing. The water rubs these stones together year after year until they rub themselves away into

tiny grains of sand. This sand acts like sandpaper on other stones which are carried up on the shore by the waves. It helps to make them smooth and polished. At last they get rubbed and broken into grains of sand, too."

Mary said, "The water must be very strong to rub the stones so hard."

Then Jane remembered how strong the waves had seemed when she was playing in the water the day before. When some of the waves hit her, she fell down hard. Her father had to help her to stand up again. Even the water that was not very deep would not have been safe for Jane if her father had not been there to help her.

Pound! Pound! Pound! The waves hit the shore and break up the stones.

They hit great rocks that are higher than houses. They often break off great chunks from these rocks. These smaller rocks are beaten by the waves until smaller pieces break off. These rocks roll about in the water. They often knock against each other with a bang.

They bang against the shore. At last they break up into the small pebbles which Jane and Mary like to keep in their collection. All the pebbles and all the sand were once great, high rocks at the water's edge. The water broke and ground and cracked and rubbed them into small pebbles and grains of sand. The water is still doing this. It will never stop so long as there are rocks against which it can pound.

Not all the soil is sand, however. Not all the soil was made by the sea or by rivers, or lakes, or little brooks. Yet it was all made from rocks.

Freezing water breaks rocks

Many times rain falls into hollow places in rocks. Many times the water

gets into holes or cracks in the rocks. Then cold weather comes on, and this water freezes into ice.

Now very often the cracks and holes are not large enough to hold the ice which freezes there. Many times the ice is stronger than the rocks. It makes the rocks crack and break.

Many rocks are broken again and again by the water which has frozen in their cracks year after year. A pile of smaller stones is left where the big rocks once stood.

Sometimes the pieces of broken rock roll down the side of the hill. As they go bouncing along they break into still smaller pieces. They also break up the rock against which they go bumping and bouncing. They wear themselves away into soft grains of soil.

Rain and snow

Rain and melting snow carry many of these pieces into the streams. Here they meet other stones which the water is carrying along. These stones bump and grind against each other. They

often break up into smaller pieces. The sharp edges and corners wear off. They become smooth, round pebbles. In time these pebbles are ground into fine soil.

The tap, tap, tap of the rain wears away rocks. The rub, rub, rub of melting snow and running streams scrubs away the sides of the rocky hills. The hard rocks are worn away into soft soil.

3. How the Wind Helps to Make Soil

The wind too is a great helper in making soil.

Did you ever see an old flag which has been blowing in the wind for a long, long time? Its edges are worn and ragged. If the flag had been left

flying long enough, it would have been "blown to pieces." Nothing would have been left.

The wind wears or blows away the rocks in the same way. It wears them away very, very slowly because they are so hard and strong. Here is a picture of rocks which have been worn away by the wind.

You cannot see the pieces of the flag that were worn off by the wind. They are so small that no one sees them. The pieces which the wind wears off of rocks are small and fine too. No one sees that they leave the rock. But pieces as fine as dust are being blown from the rock all the time. This rock dust falls to the earth as soil.

The wind blows sand and other kinds of soil against the rocks. This wears away the rocks. The rocks by the seashore wear away very fast when the wind blows the sand against them.

Almost everywhere the wind blows, it carries about dust and sand. Even ships at sea become dusty. The wind makes this dust.

In some places the wind makes hills of sand. It piles up the sand like huge snowdrifts. These drifts, or piles, of sand are called sand dunes. Children like to play in the sand dunes. They like to slide down the soft, sandy hills.

In some places the wind blows the hills of sand about. The Stone family liked to have picnics on the sand dunes.

One day Jack said: "Let's have our picnic on the big hill in the middle this time. You can see all around from that hill."

Mr. Stone said: "We had picnics on this sand dune when I was a boy. But it was not in the middle of the field then."

"Where was it? Can a hill move?" asked Jack.

"This hill has moved," replied his father. "When I was a boy it was over there by those bushes."

"How can a hill move?" asked Jack.

"For years and years the wind has blown the sand along," said Mr. Stone. "At last the pile of sand is all blown away from the old place. It is piled up in a new place."

"Will this hill go farther on?" asked Jack.

"A little farther," said Mr. Stone. "That row of trees will stop it by and by."

"I wonder how old I shall be when it reaches the trees," said Jack.

"We shall have to wait and see," replied his father.

4. How Plants and Animals Help to Make Soil

Of course you know that the soil helps to make plants. Did you know that plants help to make soil? This is how they do it.

Plants grow in the soil. Their roots are twisted in and out among the grains of dirt. When plants die many of them are never cleaned away. They

drop to the ground and lie there. The rain beats them down into the earth. After a while these plants decay. They soften and become a part of the ground. More soil is made on top of them. After a while you could not tell the plants from the soil. This makes good black soil. This kind of soil is found in the woods.

Mosses and other plants grow on the sides of rocks where there is a little soil. These plants use up part of the rock where they are growing. Sometimes rocks are worn away by the plants which grow on them.

Animals

The same thing happens to many insects and other animals which die.

Their bones sink down into the earth and decay. Plants grow well in this soil. People like to have this kind of soil in their gardens.

Things to Do

1. Bring different kinds of soil to school. Have a jar of sand, a jar of clay, a jar of soil, from the garden, and a jar of soil from the woods.

2. Do these soils look quite different from each other? Do they feel different?

3. Put a small pile of each kind of soil on a piece of paper. Look at them through a magnifying glass. Can you see how each kind of soil is different from the rest?

4. Make a collection of stones in

school. See how many different kinds of stones you can have.

5. Put the hard stones together. Put the soft stones together. Some stones are quite soft.

6. Can you make soil from stones? Rub some stones together. Rub a hard stone against a soft one. You can have a little pile of soil in a short time.

7. Rub two hard stones together. How long do you think it would take to grind these into sand?

II · HOW ROCKS ARE MADE

You have been reading about how soil is made from the rocks. Do you wonder where the earth gets these rocks from which the soil is made?

Once upon a time the whole earth was rock. No people or plants lived on the earth in those days. There was no place for anything to live. Rock was everywhere. The whole earth was rock.

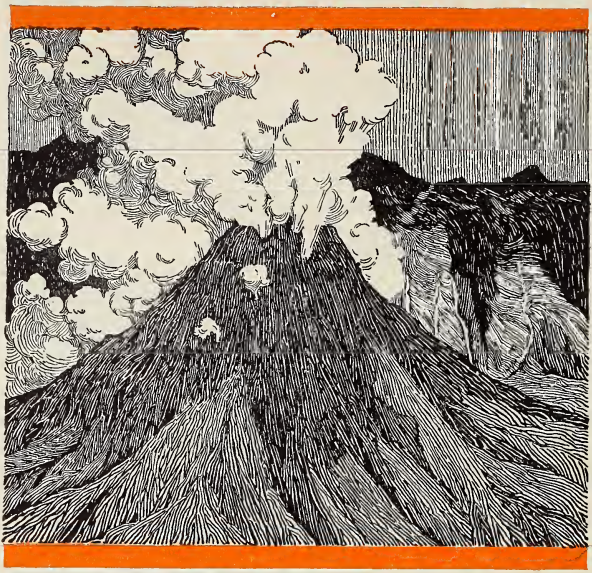
For millions and millions of years the water and the wind wore away these rocks. At last the earth was covered with a blanket of soil.

Can you imagine what the earth was like when it was just rock? We know that rocks make soil. Here is something very strange. Soil makes rocks! It works both ways, turn and turn about. Rocks make soil, and soil makes rocks.

1. Rocks Made by Heat

Rocks have been made in different ways. At times the rocks on the inside of the earth have become so hot that

they melted. You have watched water boiling. You have seen the steam push up the cover of the pan. Sometimes it pushes up the cover and boils out of the pan onto the stove. These melting rocks did something very much like this. They pushed a big crack, or hole, through the top of the earth. They made their way into this crack and



then became hard. Sometimes they found a place that cooled without breaking through the top of the earth. When these rocks cooled they were very, very hard. Granite is one of our hardest rocks. Granite was made in this way.

2. Rocks Made from Soil

Did you ever watch the water in the gutters after a hard rainstorm? It often makes a little river. Sticks, straws, papers, stones, leaves, and all kinds of rubbish are carried along by this little stream. Much of this rubbish is left near the hole where the water runs down into the sewer. Sometimes, after a storm is over, a thin cover of mud is left on the pavement.

If you live in the country, perhaps you have watched something like this happen in a little brook in the meadows. After the hard rain is over, mud and leaves are spread around on the banks which did not hold mud and leaves and sticks before. Much more mud and rub-

bish must have been carried farther on by the stream. At last much of it dropped slowly to the bottom.

The same thing happens in large rivers. Mud, stones, leaves, and sticks are carried along for miles by these swiftly moving streams. By and by they flow more slowly. Because they are not going so fast, they drop their load. Sometimes it settles on the banks. Sometimes it settles on the bottom.

As this mud piles up, it presses harder and harder on the part that is underneath. When it has been pressing and pressing for years and years, the part on the bottom slowly turns to stone.

Some of this rock is made of sand. It is called sandstone. Many houses

are built from sandstone. Stores, post offices, and other city buildings are made of sandstone. You can tell sandstone when you see it because it looks like millions of grains of sand all stuck together.

Other rocks are made from softer and finer soil called clay. The rock which comes from clay is called shale. This kind of stone is smooth and rather soft. It lies in large flat pieces in the ground.

III · HOW RIVERS ARE MADE

Did you ever stop to think that rivers are something like street cars? They run along in the same track year after year.

Sometimes a street car runs off the track. Sometimes a river flows over its banks. But almost always a street car runs safely along on its track. Almost always a river runs safely along in its river bed.

Most of us know where a street car gets its tracks. Do you know where a river gets its river bed?

1. Little Brooks

Helen liked to play in a tiny meadow brook on their farm. In the summer the water hardly reached her ankles. The sides of the brook, however, reached nearly to her waist. When she sat on the bank, she could just reach the water with her feet. On the borders were large stones. In the bottom of the

brook were pebbles and sand. Can you tell why the pebbles and sand covered the bottom of the brook?

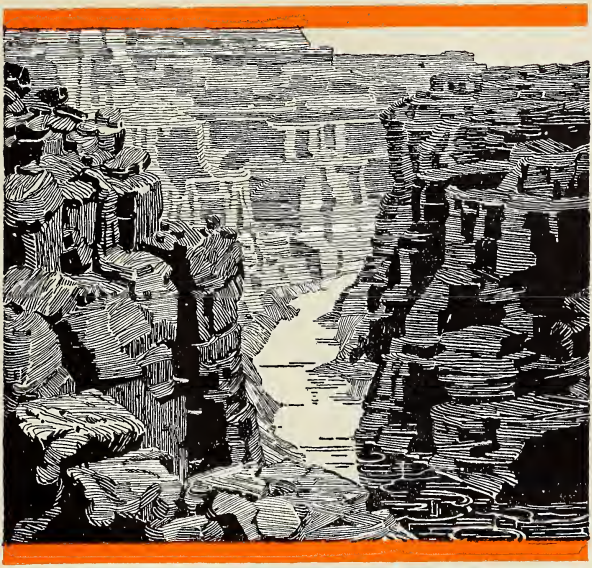
Do you wonder why this stream happened to have such high banks, or sides? In the springtime the melting snow and rainy weather gave this little brook a great deal of water. It rushed rapidly

along, cutting and pushing and digging as it went. So much water has to have a place to flow. Each year the brook dug a little bit deeper. This made the banks a little higher. Each year more rock and soil were worn from the banks. Each year the pebbles were worn smaller.

Helen asked her father how much higher the banks would be when she was a grown-up woman. Her father said, "They may be a few inches higher. They change very, very slowly."

2. Big Rivers

Helen's mother told her about a very strange river which is called the Colorado River. Its banks are very high. "This wonderful river has cut its way



down, down, down through a great wall of rock," she said. "When you stand on the banks at the top, this great river looks like a long yellow ribbon. It looks as small as a ribbon because you are a mile away from it. Its banks are one mile high."

"One mile!" said Helen. Then she tried to think how far a mile is. Her grandmother lived a mile away. Helen often walked to her grandmother's house, but she was always glad to sit down when she reached it. Her legs were tired after a mile's walk.

Her mother said: "Yes, the river has cut its way for a whole mile through the rock. Think how much soil the river has carried away."

Then Helen said: "How fast the river must flow to cut a mile into the earth! How long did that take?"

Her mother said: "Millions and millions of years. The river is very, very old, you see, and the rocks are very much older."

Things to Think About

1. It takes a long, long time for the rocks to be worn away into soil.

2. The children were talking about this one day. Jack said, "It takes years and years for the water to wear away the rocks on the seashore."

3. Helen said, "It takes an awfully long time for the rains and melting snows to scrub away the rocks on the hillsides."

4. Bill said, "It takes hundreds of years for the ice to crack the rocks and break them up into soil."

5. These children were right. It does take a long, long time for these changes to take place. Many years are needed for the plants to turn the rocks into soil. Years and years and years pass

by while the wind is wearing the rocks into soil.

6. More years than you can count go by while some of the soil is being turned back into rock.

7. It takes many, many, many years for a river to cut its way through a wall of rock or soil.

8. The earth is very, very old.

Things to Do

1. Do you like to find stones and put them in a collection? What do you do with your stones after you have collected them? Do you put each kind in a place by itself? Do you try to find out the names of the stones you have? Do you try to find out how the stones are made? Do you try to find out how people can use the stones?

2. Did you ever have a stone like this?

Shiny and sparkling.
Seems very hard.
Pinkish in color, black or gray mixed in.

This may be granite. It is one of our hardest stones. In what way do you think this stone was made.

3. Did you ever find a stone like this?

Soft and yellow
Has fine grains

Children use it to play "hop scotch" on the sidewalk. This may be limestone. How do you think this stone was made?

4. Here is a pretty stone which most children want in their collections.

Looks something like glass.
Sparkles, but not like granite. Its edges are larger and smoother.
Pink in color.
Seems very hard.

This may be rose quartz. How do you think this very hard stone is made?

5. Most children have a stone like this in their collection.

Rather soft with coarse grains.
Small pebbles and sometimes shells mixed in with coarse grains which look like sand.

How do you think the small pebbles found their way into this stone?

UNIT VI

How Animals Grow Up

I · ABOUT RABBITS

1. A Rabbit Family

Grace, Betty, and John had a pet rabbit. Their pet was a strange pet. Their pet rabbit was a wild rabbit. She was a mother rabbit with four babies.

She lived under some bushes. These bushes made a fence at one side of the pasture lot. You would not know the rabbit home was there. It was hidden away so carefully underneath the bushes.

What a surprise to find a rabbit's nest!

The children were sitting on the grass eating their lunch. They were resting after a long walk to the woods. The mother rabbit poked her head out

of the bushes. Very carefully she looked about. She was coming out for food.

John saw her. But she saw John at the same time and ran back into the bushes.

John pulled the bushes apart, hoping to see her again. Then the great surprise! The children saw a mother rabbit with four baby rabbits in a nest. The mother rabbit looked very much frightened.

John let the bushes fall back over the nest. He said: "Let's have this for a secret. We do not want anyone to harm our rabbit family."

The children went to the garden. They brought lettuce and carrots to the mother rabbit. They kept very still and waited a long time. At last the mother

rabbit came out from the bushes. She took the lettuce in her mouth. But she ran back to the bushes to eat it.

Each day the children brought vegetables for their rabbit. At last she would eat out of their hands. She was not afraid of the children any more. She would even let them look at her babies. They were always very quiet with the rabbit family.

Baby rabbits are born in soft nests of straw or hay or grass. The mother rabbit makes the nest soft and warm with her fur. She pulls the fur from the under part of her body. This does not hurt the mother rabbit. The fur is loose and comes out very easily.

There are from four to six babies at a time. The mother rabbit has four or five families during the summer. No wonder there are so many rabbits in the world!

Young rabbits are bare little things. Their eyes are closed. They eat or sleep most of the time. Their first food is the mother's milk.

Grace said, "Their mother gives them their dinner just as our old Tabby-cat feeds her kittens."

"They are not pretty," said Betty.

"They will be pretty after awhile," said John. "They will be covered with fur quite soon."

Sure enough. In about a week the rabbits were very pretty babies. Their eyes were open. Their bodies were covered with soft gray fur. They began to hop about. They followed the mother rabbit wherever she went.

In about three weeks the rabbit family had left the nest in the pasture lot. The young rabbits were able to care for themselves now. So the whole family left the nest.

After that the children often saw rabbits in that place. But they could not tell which rabbits they had once called their pets.

2. More about Rabbits

If you want to find a rabbit's nest, do not look in the middle of the field. Always go to the edge where the bushes are. Rabbits choose bushes which grow close to the ground. They often hide under thorn bushes.

Most animals cannot crawl in and out of such places. Their hair is easily tangled in the branches. Rabbits are quite safe, however. Their hair is smooth, short, and straight. It never catches on the brambles. It is very thick. The thorns do not scratch through it.

Rabbits eat vegetable foods. They do not eat meat. They do not catch other animals and eat them. Their teeth are not made to bite and tear meat.

On page 66 you can read what rabbits eat in winter. In summer they find fresh grass and leaves. They eat young twigs and the bark of trees. How they like to get into a garden! What a good dinner they have on the lettuce, beets, radishes, and other good vegetables! Early morning and evening are the best feeding times for rabbits. Their eyes are made so that they can see clearly, even in a dim light. Their enemies cannot see them so plainly in a dim light.

Rabbits are strange little animals. They act very shy. They seem to be frightened by anything which comes near them. They run and hide at the first strange noise. But these scared little animals make their homes among their enemies.

Sometimes rabbits make their homes in parks and on people's lawns. Dogs are always found in parks or on people's lawns. Many rabbits live in pastures and in fields. Hawks and owls and weasels look for their food in pastures. In some parts of the country wolves and coyotes run about the fields. All these animals are enemies to the rabbits. Do you wonder how rabbits can live so safely among their enemies?

Rabbits have a habit which helps them very much. They do not stay frightened. They may run to their hiding places in a great fright. But the minute the danger is over they will go back to the very spot where the trouble took place. They act as though nothing had scared them.

Rabbits can run at great speed. They cannot run very far, however. So they stay quite near to a hiding place. When an enemy comes near, they run as fast as they can go to a safe place. Rabbits will hide in any hole they can find. They often run into old woodchuck holes. They will even climb up inside a hollow tree.

Rabbits can hear the least little sound. Their long ears can turn in the direction of any sound. They can see well, even in a dim light.

Sometimes their hiding place is too far away for them to reach. Then they sit still. They do not move a hair. Their coats of brown and gray fur are much like the dry grasses. Their enemy may not see them at all and go on by them.

Rabbits get rid of their small enemies by pushing them over. They give a hard kick with their strong hind legs. Then they run away.

It is fun to follow rabbit tracks in the snow. The tracks of the hind feet are ahead of the tracks of the front feet.

II · PORCUPINES

Rachel, her father, and her mother were staying at a summer camp in the mountains.

One night a strange sound woke them up. "Crunch, crunch, crunch," it went.

Father said: "That is our friend, the porcupine. He is chewing our box of salted meat. He had better get away from here."

Mother said: "Do be careful. Don't get too near him."

Father pounded on the floor, and the porcupine went away.

By and by they heard the sound again — crunch, crunch, crunch. This time old Louis, the Indian guide, began

to move about. "I'll get him," he said, as he lighted a lantern.

The noise soon stopped, and everyone went back to sleep.

The next day old Louis said: "I surprised that old porcupine last night. He walked right into this trap."

The trap had not hurt the porcupine. Afterwards he was put into a wooden box. One side of the box was open to give him air. A screen was fastened across the open side of the box. The screen was fastened so that he would not run away.

Rachel named the porcupine "Mike." She fed him cabbage leaves and raw potatoes.

Should you like to know how Mike looked? He had a wide, flat nose and

small, round, black eyes. He had short legs and wide, flat feet. His coat was very strange. Except for his nose, his legs, and underneath his body, Mike's coat was made of needles! These needles were quills about three inches long. They had sharp little hooks at the ends. Usually these quills would lie down flat. But when anyone bothered Mike his quills would stand out straight from his body. Then he looked like a great ball of needles.

One day Louis said, "Now that porcupine has given me a surprise!"

Rachel looked into Mike's box. Mike was not there. There was a hole in one side of the box. Mike had chewed his way through and had run away.

Louis gave Rachel a little basket which his wife had made from porcupine quills. It was carefully woven. Rachel could hardly believe that it was made from quills like Mike's.

When Rachel went back to the city, she visited the museum, where you can see many interesting things. She saw how the Indians had used porcupine quills to embroider beautiful things. They had embroidered headbands and bags for arrows with porcupine quills.

Rachel said: "The quills in my basket

are yellow and white. Mike was a black porcupine. Are some porcupines yellow?"

Her mother said: "If you look carefully, you will see that the end of each quill is black. Between the quills are long black hairs. These hairs and the black tips of the quills make the porcupine's coat look black."

Porcupines do not need to be afraid of enemies. They do not like to fight, but they take care of themselves very well.

If an enemy goes too near a porcupine, whack goes his thick, strong tail.

The enemy usually runs away, howling with pain. Dozens of sharp porcupine needles are sticking into his body.

What a sight a dog is after he has met a porcupine! The quills usually are left in the soft flesh around his mouth.

Some people say that a porcupine can throw his quills out of his body. This is not true. However, the quills are fastened to his skin very loosely. When the hooks, or points, catch into the flesh of an animal, the quills come out very easily.

Porcupines make their homes in woods. They like to live in hollow trees. Many of them have their homes in caves. These caves are under old trees, large rocks, or piles of broken branches.

During the coldest days of winter, porcupines stay in their houses. As soon

as the weather grows a little warmer, they come out to look for food.

Porcupines seem to choose the food which people do not want them to eat. In the winter they climb up into the evergreen trees. They chew rings of the bark from many of the branches. This soon kills the tree, of course. In the summer they eat buds, fruits, and leaves. They like lily pads very much.

What a trouble porcupines are around a camp! They will chew at almost anything that tastes of salt. They chew old boxes or barrels in which salted meat has been packed. Oar handles and ax handles often have a salty taste. They are sometimes chewed into bits.

Indians eat the flesh of porcupines. But white people have little use for it.

Baby porcupines would not make very nice pets. Late in the spring the babies are born. They are very large and strong. There are from one to four babies in a family. When they are born they are covered with soft quills. When they are about half-grown they leave to find a home and food for themselves. Do you think they would be quite safe after they had left their mother?

Do you wonder that Rachel's mother said to her father: "Do be careful. Don't go too near"?

III · ABOUT SQUIRRELS

1. The Story of Dick

Dick was a pet squirrel. He belonged to the children in Miss Gordon's class.

Mary and Bill found him when he was a tiny baby. He was lying on the ground under a tree. He had fallen from his nest. They brought him inside at once. They did not want a dog or a cat to find him.

Dick became a very happy squirrel. The children fed him warm bread and milk. That seems like very soft food for a squirrel. But you must remember that Dick was a baby squirrel. Up to this time his food had been the milk which his mother fed him.

After awhile he could eat carrots,

lettuce, and dandelions. That seems like rabbit food. But squirrels, too, like vegetables. Dick liked the nuts which the children cracked for him. Although he had four sharp little front teeth, he could not bite into nuts. His jaws were not strong enough.

The early spring days were quite cool. The children made a bed for Dick. His bed was a shoe box. Pieces of soft

cloth made it warm and comfortable for a baby squirrel. They kept the box on the floor by the radiator.

Dick took long naps. He would curl up, wrap his tail around himself, and sleep most of the day. Sometimes he would spread a piece of cloth over his body like a quilt. It was fun to watch him get ready for his nap.

The spring days grew very warm. The children placed his bed on a window sill. Dick learned to climb up here by himself. He would jump from a

chair to a table. Then he would hop to the window sill. These were short jumps. A little squirrel cannot jump very far.

By and by Dick began to take long jumps about the room. He would leap from Miss Gordon's desk to the top of the bookcase. His box of corn was kept here. This was his first long jump. Can you see why he dared to leap so far?

Once in a while Dick would not reach the spot where he meant to land. Sometimes he would strike his nose when he fell. How he would shake his head and sneeze! He would rub his poor nose as you would rub yours if you bumped it.

As Dick grew older it was no trouble to feed him. The children would call "Dicky, Dicky." How he would run to the spot where his food was lying!

Sometimes the children would hide his food under chairs or in a corner. Dicky would always find it. They had to keep his corn in a tin box with a cover. They kept his vegetables in a covered box, too. They did not want him to eat too much.

Dick liked to play with the children. He liked to chase marbles. He would play with a ball of paper as a kitten does. He would sit on Mary's shoulder and take a peanut from her teeth.

Dicky did not like strangers. When a stranger came into the room, Dicky would run away. With a long jump or a quick run he would dash out of sight.

Vacation days grew near. The children wondered who would care for Dicky when school closed.

Miss Gordon said: "Dick is a big squirrel now. He can find his own food. He can find a place to sleep. He can run away from his enemies. Do you think he needs anyone to take care of him?"

The children said: "He can take care of himself now. Let us put him back in the park where we found him."

So they did. During the summer the children visited the park. They thought they saw Dick. But they never could be sure.

2. Other Squirrels

Dick needed a great deal of care. The children said: "How do the wild squirrels take care of themselves? How do they live and grow?"

Where to look for squirrels

You can often see squirrels when you go to the park. You can often see them along the streets in towns which have many trees. You can often see them when you are riding in the country.

What are their homes like?

Squirrels have all kinds of homes. On page 63 you can read about the strange places where squirrels live in the winter. Their nests for the baby squirrels are also made in these places.

Sometimes a person nails a box to a tree trunk so that the squirrels may have a nest.

Squirrels often make their own nests in tree tops. These nests seem to be a loose pile of twigs and leaves. They

look as if the wind would blow them away. But they are stronger than they look. Grasses and twigs hold the leaves together. The nest is soft inside. Bits of bark, moss, or grasses make a comfortable nest for the baby squirrels.

What do squirrels eat?

On page 64 you can read what squirrels find to eat in the winter. Sometimes they have a hard time to find this food.

In summer the squirrels can find plenty of food to eat. They eat berries and other fruits with seeds. They eat plums, peaches, and cherries. They like to eat the seeds. They like mushrooms too. The corn fields and wheat fields give them many good dinners.

Squirrels like to eat some insects. Sometimes they eat birds' eggs and kill the baby birds. Red squirrels are very bad about that.

The body of a squirrel

Do you wonder how squirrels are able to move about so quickly? They flash past you almost as quickly as birds do. Their bodies are built just right for the kind of life they have to live.

A squirrel has to move very quickly. He has to jump very far. He must climb on the thin branches of trees. His body is light. It is not fat. It is long and slim. His bones are small and light. He can hold tight to the branches with his paws.

His long bushy tail is like a sail when

he jumps. The tail often keeps him from going too far. It often keeps him from tipping or falling. It helps to steer him to a place where he wants to land.

A squirrel's paws have long toes which are very much like fingers. The front feet are almost like little hands. Squirrels hold a nut in their front paws as you hold a big apple in your hands. Sharp claws help them to climb and to hold on to a swinging branch.

A squirrel's four front teeth are like sharp knives. The shell of a nut comes

off as easily as the skin of an apple when such sharp teeth are biting it.

The enemies of squirrels

Squirrels have many enemies. Cats, dogs, weasels, large birds, snakes, and many other animals are enemies to the squirrels. They are always ready to catch the squirrels if they can.

Squirrels are very clever in getting away from their enemies. They move about so fast that their enemies often do not know where they have gone. Their long jumps help them to get away.

Red squirrels scold and chatter and fight. They scratch and bite. They have been known to drive away their cousins, the gray squirrels, which are nearly twice as large.

Squirrels and people

Squirrels are a bother in many ways. Can you think of some ways in which squirrels might be a bother to people?

Think of the places where squirrels build their nests. Would any of these nests be a bother to people?

Where do squirrels get much of their winter food? Does a farmer like to have the squirrels get into his grain and vegetables?

Squirrels scatter their nutshells all about. Does this make a place look very neat?

What else can you tell?

In other ways squirrels are a great help in the world. They help to plant new forests. Many of the nuts and

seeds which they store away are never eaten. Sometimes these grow into oak trees or walnut trees or pine trees. What other trees do you think they plant?

IV · THE STORY OF THE SKUNKS

Skunks are beautiful little animals. They are useful little animals, too.

Skunks are about as large as cats. They have little, pointed noses and round, bright eyes. Their fur is shiny black with white stripes along the sides. Their tails are long and bushy.

When danger is near, up goes the skunk's tail over his back. A person or an animal should go away as soon as the skunk raises his tail over his back. That beautiful tail is a danger signal.

Sarah Ann saw two baby animals slowly creeping along the walk which led from the barn to the garden. They were pretty little black and white things with long bushy tails.

"You pretty little kittens!" she said. "I must show you to my mother."

Sarah Ann put the little animals in her apron and carried them to the house.

When Mrs. Smith saw them, she said: "O dearie me! You must let them go back to the barn right away. These babies do not belong to a mother cat. They belong to a mother skunk!"

Sarah Ann remembered that her father had told her about a family of skunks. He said that they were living under the old barn.

Suddenly she remembered something else. Scotty, the dog, once had an accident. He had gone too near a skunk. A very strong smell stayed with Scotty for many days.

People said: "Keep away, Scotty! Keep away."

Poor Scotty had to stay away from people until the bad smell had left his fur.

Sarah Ann did not want to take the skunk babies back to the barn.

"The mother skunk will not like to see me with her babies," she said; "I am afraid she will punish me for taking them away."

But Sarah Ann took them back to the place where she had found them. The mother skunk came back from her visit to the garden. She did not see Sarah Ann. She took her babies back to their nest under the barn. Sarah Ann was safe.

Suppose that the mother skunk had seen Sarah Ann with her babies. Do you know what might have happened?

Underneath the skunk's tail are two little bags called scent bags. When skunks are frightened, they squirt a liquid from these bags. This liquid has a very bad smell. Anything which has been touched by this liquid has a bad smell for a long, long time.

Some people think that an animal will grow blind if this liquid gets into his

eyes. This is not true. But any animal which has been touched by this liquid is not very comfortable. He doesn't want to go too near another skunk.

Skunks are not often bothered by other animals. Their way of taking care of themselves is swift and sure. Even porcupines are afraid of them.

Skunks are good friends to farmers. Their food habits make them very useful.

Some people say: "Oh, skunks are no good. They eat birds' eggs and steal chickens."

But skunks do not choose to eat birds' eggs and chickens. Grasshoppers, crickets, and June beetles taste just as good to them. Skunks eat eggs and chickens when other foods are hard to get.

Skunks like to feed on army worms. Army worms eat into the farmer's wheat heads, grasses, and corn. They often spoil these crops.

Farmers have trouble to get the tobacco worm out of their fields. This tobacco worm is another food which skunks enjoy.

Mice, rats, pocket gophers, ground squirrels, all cause the farmer trouble. Pocket gophers dig tunnels under the hayfields. They eat the roots of the plants. Skunks like to eat gophers. They eat more mice than any other animal.

Skunks can make a very good meal from earthworms too. They like berries and other fruit. Indeed, skunks eat almost anything of which there is a great plenty.

Skunks like to eat bees too. A skunk catching bees is a funny sight. "Scratch, scratch," go his claws on the outside of the hive. "Scratch, scratch," until the bees come out to sting the visitor away. Then the skunk catches them and has a good dinner. The bees light on his fur, but he doesn't mind their stings. He pulls the bees off and eats them.

Of course no farmer wants skunks to eat his bees. But he can put the beehives on high benches out of the way of the skunks.

Skunks do much of their traveling at night. Don't you think that black is a very safe color for them? Even the stripe of white helps them. It makes the skunk's body look like a black shadow.

Skunks work mostly at night. They

come out at sunset to catch grasshoppers and beetles. When the insects rise from the ground, the skunks jump at them and catch them with their front feet.

These front feet have toes like tiny fingers. The toes have strong, long claws. Skunks use their front feet very cleverly. They dig beetles from the ground. Neat, pointed holes are left when they are through. Sometimes they roll back the grass. Then they eat the insects which are found underneath.

Do you wonder how a skunk can find his food at night? Grasshoppers, beetles, and other insects are very small to find in the dark. The skunk uses more than his eyes to find his food at night. He uses his ears and his nose. His ears hear the tiny sounds which the insects make as they move about. His nose smells many kinds of food.

Skunks sleep during the coldest weather. They spend this time in their dens. Sometimes as many as twenty skunks sleep in the same den. They do not dig their own holes if they can find another place to sleep. They are glad to live in homes which have been left empty by woodchucks, foxes, or badgers. When the winter days are warm, they wake up. They tramp around looking

for food. When the weather turns cold again, they go back to sleep in their dens.

Their nests are found in strange places. They sleep in holes under tree roots and fallen trees. Families of skunks have been found under floors of barns, woodsheds, and country schoolhouses. They have made their homes in cellars and in caves for storing vegetables. They have even made their homes near steam pipes under the ground. They seem to want a warm place for their winter naps.

The soft nest is made of leaves and dry grass. Early in the spring from six to twelve babies are born. They are not pretty babies. Their eyes are closed, and they have no fur. They need quite a bit

of care. The nest has to be warm for them. At first the mother feeds her own milk to them, as a rabbit mother feeds her babies.

After three or four weeks their eyes are open. Soon they begin to follow their mother about to get food. They stay with her until they are almost full-grown. They are really "grown up" when they are six months old. They often stay with the mother after they are grown up. They stay together during the winter.

If you should see a skunk what would you do?

The girls in a summer camp used to watch some skunks at night. The skunks would race up and down the field. Sometimes they would stop to look for food.

Many times they ran on until they came to the hayfield that was near. The girls would sit up in bed to watch the skunks go by. They never frightened the skunks. The skunks never threw out their bad-smelling liquid. They did not need to do so. They were safe from harm.

V · BOB AND THE RACCOONS

1. The Raccoons at the Zoo

Bob liked to visit the zoo. His home was close by. He could go in to see the animals as often as he wished. Among the animals that he liked best were the raccoons.

How to know a raccoon

Bob always wanted to laugh when he watched a raccoon's face. They have funny, pointed noses. Their small ears stand up straight. Their black eyes are bright, shiny, and full of mischief.

Raccoons have a black spot around each eye and across the nose.

"That black spot looks like a pair of motorcycle goggles," said Bob.

A raccoon is a pretty animal. The fur is thick and fluffy. His color is a yellow-gray. The tail is long. The fur on the tail is thick and fluffy, too. Four or five rings of black fur make a raccoon's tail very beautiful.

Bob's big brother received a raccoon coat for Christmas. He liked it very much. After that Bob noticed a great many people wearing raccoon coats. Years ago people used to think raccoon caps were very fine. The long raccoon tail hung down from the back of the cap. People who do much riding in cold weather often wear caps made of coonskin. They have coonskin robes to put over their laps.

Bob liked to watch the raccoons walk about. "They walk like bears," he said.

The raccoon's legs are short. When he walks he swings from side to side very much as a bear does. He walks flat on the bottoms of his feet. A bear walks flat on the bottoms of his feet, too. A dog walks on his toes. His feet are not flat on the ground.

A dog or a cat can run faster than a raccoon. A raccoon's body is heavy.

"He goes along on the ground like an old wagon," said Bob.

"Yes, he's a slow walker, all right," said Mr. Jones, the keeper at the zoo. "But just watch him climb!"

Raccoons can climb

The raccoons at the zoo lived in a large yard. A high tree with many branches stood in the center of the

yard. How the raccoons would race up the tree! They could reach the top branches before Bob could count ten. Then they would look down at him with their shiny black eyes. "So you think we're slow, do you?" they seemed to say.

The raccoons seemed to be just as much at home in the tree as they were on the ground. They climbed

about from branch to branch. They often stretched themselves out on the branches and went sound asleep. When they were ready to come down, they climbed down the tree, head first.

Bob said: "Raccoons are wonderful animals. They look like foxes. They walk like bears. They climb like squirrels."

"Yes, they can climb, all right," said Mr. Jones. "They learn to climb when they are very young. Their nest is often at the bottom of a hollow tree. The front door to Mr. Raccoon's house is very high. It is higher than a man can reach. The young raccoons learn to climb high up inside the trunk of the tree. That is the only way for them to get out of the nest."

A gentleman named Mr. White was standing near. He liked to watch the raccoons, too.

"Yes," he said, "coons are great climbers. When they are being hunted, they climb to the tops of trees. They climb from the branches of one tree to the branches of the next tree. They travel very far in this way. Very often the hunting dogs do not find them after they have climbed the tree."

Raccoons and their food

Bob had great fun watching the raccoons eat their food. They do not gnaw it as a dog gnaws a bone. Usually they hold it in their paws. They eat very much as a monkey does.

Their front paws are like little hands.

Their long toes are like fingers. They have four fingers and a thumb. The under part of their paws is not covered with hair. It is covered with skin. It looks like a tiny black glove.

Mr. Jones fed the raccoons fruit and vegetables. Sometimes they had fish. Sometimes they had a bird or other meat.

Before the raccoons would eat their food they did a very strange thing. If they could find some water, they carried their food to that place. Then they dipped it up and down in the water. When it was carefully washed, they ate it.

Of course some food could not be washed. Sometimes Mr. Jones gave them mush to eat. They liked this

very much. They dipped both paws into the dish. They ate one handful greedily. They ate the other handful greedily. They ate handful after handful of the mush until it was gone. Then they neatly washed their paws.

Bob always laughed when the raccoons had clams for dinner. With their teeth they opened the back, where the shells are fastened together. They pushed the clam out of the shell with one paw. When that was eaten they drank the juice from the shells.

They ate raw eggs in much the same way. They broke the shell with their teeth. They lapped the egg from the shell as if it were in a little dish.

2. Raccoons in the Woods

How they live

Mr. White told Bob that raccoons like all kinds of food.

They stay near streams of water which flow through the woods. You can see their tracks very clearly. Someone said they look like the footprints of a baby.

They catch toads and frogs. They find clams and eat them. They catch the small fish that they can find near the water's edge. They can swim, but they cannot dive into deep water

for fish. They eat birds and their eggs. They eat snails, and they eat mice. They eat nuts, fruits, and vegetables.

Raccoons often come to farms to look for food. But they will not stay in buildings where people are living. They are a great bother to farmers. They steal hens and chickens. They steal melons and corn.

They cause great trouble in a corn field. They break down the cornstalks to get the ears of corn. They eat a little here and a little there, but they do not eat a whole ear. They waste more than they eat.

"Coons do much of their hunting at night," said Mr. White. "They sleep in the daytime. They can see quite well at night. It is safer for them to hunt

around at night. People and many of the animals are asleep. At that time they catch birds and eat their eggs."

Raccoons do not like to live alone. A number of them hunt and travel about together. Usually one large family travels together. The young raccoons stay with the mother until they are about a year old. There are from three to six of them in a family.

Raccoons in winter

Mr. Jones told Bob another interesting thing about raccoons.

"Coons sleep during the winter," he said. "They crawl into a hollow tree or into a safe cave. They choose a place which is warm and out of the way of snow and rain."

"I should think animals would starve when they sleep all winter," Bob said. "They cannot eat when they are asleep."

"Raccoons get ready for that," said Mr. Jones. "In the fall they eat and eat until they are so fat that they can hardly walk. They eat until cold weather comes. The cold weather sends them to bed for the winter."

"I should think they would be hungry when they wake up in the spring," said Bob.

"They are very hungry," said Mr. Jones. "They live on their fat in the winter. But when spring comes they are thin and weak. They begin to look for food as soon as they wake up. Before long they look like themselves again."

"Don't they wake up at all during the winter?" asked Bob. "Doesn't the noise of a hunter's gun wake them up?"

"A loud noise does not bother them," said Mr. Jones. "But warm weather wakes them up. If some warm days come in winter, raccoons will come out for food. As soon as the weather is cold again they go back to sleep."

"I shouldn't like to sleep like that," Bob said. "I have too much fun in winter."

"It would save buying you a winter coat," laughed Mr. Jones.

3. A Pet Raccoon

Bob's father said: "Raccoons make very interesting pets. I had one when I was a boy on the farm."

"What did he do?" asked Bob.

"He was a great bother," said Bob's grandmother. "Whenever he got into the pantry he ate everything in sight. He made a number of visits to the pantry, but his last visit was the worst of all. He ate little bits of my pies and cakes. He ate bread and butter. He pushed the cover off the lard can and ate some of the lard. He tasted the jelly. He lapped up some honey and some molasses which were standing in saucers. He even pulled the cork out of a catsup bottle."

Father laughed. He said grandmother was right. "Once or twice someone left the door to the pantry open. Once he crawled in through the window," he said.

"We named him Pete," Father went on. "It was fun to play with him. He liked to run after a ball. He liked to tear up a newspaper and play with the pieces. He had great fun chasing feathers about.

"He liked to climb on people. He would put his hands in our pockets to see what he could find to play with. He took delight in anything which was shiny. You know that people trap raccoons for their fur. They often put a piece of shiny tin in the trap. The raccoon is caught in the trap when he touches the shining tin."

"I remember when Pete spent the night in my kitchen," said Grandmother.

Father smiled again. "Pete was very bad that night," he said.

"Yes, indeed," Grandmother went on. "He had a real wash day. He stole some meat, washed it, and ate it. Then he washed a dish towel. He washed your father's cap. He washed some fishlines and left them in a snarl to dry."

Bob laughed and laughed. "It wasn't so funny when it happened," said Grandmother.

"Pete was very strong," Father said. "He had a fight with a dog once. The dog got the worst of the fight. At last Pete became such a bother that we had to take him back to the woods."

"I wish I could have a raccoon for a pet," Bob said.

"I think it is better for you to enjoy the raccoons at the zoo," his mother said.

What do you think?

VI · DOGS

Dogs are fine friends. Did you ever have a dog for a pet? If you did, you learned to love him very much. Your dog loved you too.

What are some of the ways by which dogs show that they like the person who owns them?

Do you know a story about a dog who showed his love for his master?

Some dogs are very clever. They can learn to do many tricks. Have you ever seen the trained dogs in the circus?

Can your dog beg for food? Can he play ball with you? Can he jump through a hoop? Can he bring back a stick when you throw it?

It is not hard to teach a dog to do tricks. You must be very kind to your dog when you are teaching him.

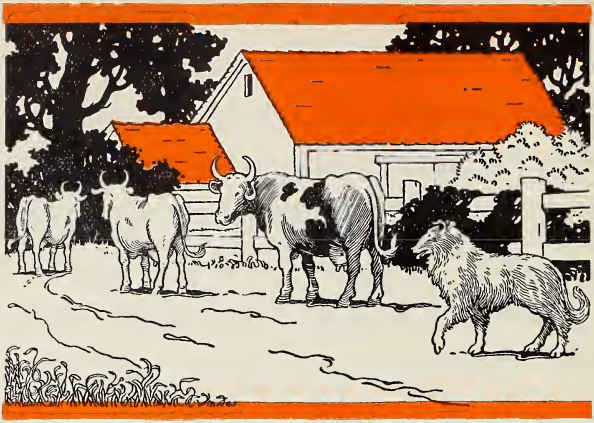
Cats cannot learn to do many tricks. Dogs seem to know much more than cats do.

Can you tell a story about a dog who was very clever?

Dogs are very useful. In many places people cannot get along without dogs.

A farmer always needs a dog. The dog helps to drive the cows to pasture and to bring them back again. He takes care of the farmer's sheep. He keeps them from getting lost.

A farmer always needs a watch-dog. A dog hears the smallest sound. He scares away hawks, raccoons, or



other animals which harm the farmer's chickens or his grain and vegetables.

Even a very small dog can be a good watchdog. What two things can a dog do to look after places and people?

People have many uses for dogs. In some countries dogs are used to pull milk carts. Some people use them to pull carts filled with wood.

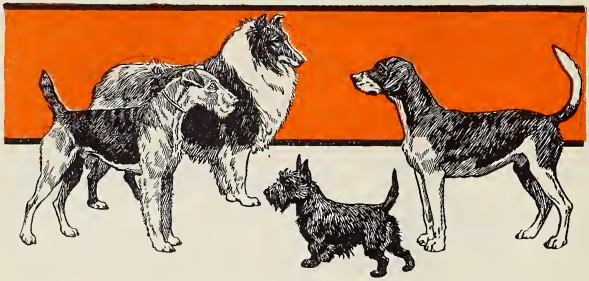
What would the Eskimos do without

dogs? Dog teams pull the Eskimos' sleds for miles on the snow. Eskimos and other people living in the Far North could not travel on land without their dogs.

People used dogs in the earliest days. Even the cave men had dogs. They needed dogs when they went hunting. They used them for watchdogs. The dogs would bark and wake up the sleeping cave men when the wild animals came too near.

Perhaps you have read stories about the dogs which the Indians kept. The white men did not like the Indians' dogs. They were wild and dangerous.

Dogs can smell in a wonderful way. They often find people who are lost. They smell the ground where the per-



son has walked. By and by they come to the place where the lost person is.

Dogs are great hunters. They can follow an animal by smelling his tracks. They chase deer for miles.

Do you think dogs like to gather together? Did you ever see a pack of hounds starting out for a hunt? How happy they seem to be as they run along together!

In some places wild dogs are found. Probably these dogs were once tame. People may once have lived in these

places. When they went away, they left their dogs behind. Perhaps other dogs ran away from their homes and became wild.

These wild dogs travel in packs. They run together. They hunt together. When food is found, each dog gets his share. That is how they keep alive. It is easier to get food in this way. There is less danger from their enemies when they travel in packs.

Wolves and coyotes are cousins to dogs. They too travel in packs. Foxes also are cousins to dogs.

Did you ever see a dog try to hide away food? Dogs often bury bones. They remember where the bones are buried. They dig them up and gnaw at them when they are hungry.

Dogs choose strange places in which to bury their food. Did you ever hear of a dog who buried a bone under a rug?

The city is not a good place in which to own a dog. City dogs must be given much care and attention in order to be healthy. A city dog must be fed very carefully. He cannot be fed scraps from the table. It is not safe for him to find his own food.

A dog must run and run in order to be healthy. In the country a dog has room for plenty of exercise. If he has enough exercise he can eat many kinds of food.

Things to Do

1. How many different kinds of dogs can you name? Here are a few kinds of dogs:

Airedale	Scotch terrier
collie	hound

2. What others can you name?

1. The Pet Cat

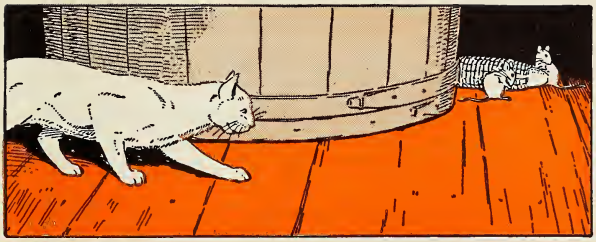
Every boy and girl knows about cats. Do you own a pet cat?

Do you know how to care for your cat? What do you feed your cat? Do you feed him vegetables? He likes meat best, but vegetables are good for him. Cats should have a taste of catnip once in a while.

Can your cat find food for himself? What food does he find? How does he catch his food?

Cats are great hunters. If there is any food for them to find, they are quite sure to find it.

Cats have been known to catch as many as twenty mice in a day. But



some cats like birds as well as mice. If your cat catches birds, you must watch him. You may have to get rid of him. It is very hard to teach a cat not to catch birds.

A cat's body is well made for hunting. He has long, strong legs. He can run fast. He can take long jumps.

The cushions on a cat's feet make him walk very softly. When he jumps for the mouse or bird, he does not miss it. His sharp claws hold it. It cannot get away.

A cat's sharp teeth tear the food apart. A cat likes meat.

A cat hunts at night. He can find his way around very well in the dark.

Look at a cat's eyes in the daytime. In the middle is a black line. This is the pupil of his eye. It is the place where the light goes into his eyes. The pupils of your eyes are round. In the dark the pupil of the eye grows larger so that we can see. The pupil of a cat's eye grows very large — much larger than the pupil of a person's eye. So a cat can see very well at night.

A cat can feel where he is going. His whiskers tell him whether a hole is big enough to crawl through. If his whiskers touch the edge of the hole, his body will not go through.

Does a cat need his tail? Watch his tail when he climbs a tree. What else helps a cat to climb a tree?

Do you know why cats climb trees? There are two answers to this question.

Watch your cat while he washes himself. Do you think cats are clean animals? Did you ever see a mother cat bathe herself and her family of kittens?

A cat's tongue is very rough. It feels like sandpaper. A cat's bath is not a water bath. He scrapes off the dirt with his rough tongue.

A cat seems very happy when he is curled up in a warm place. He sleeps and sleeps. Sometimes your cat sleeps nearly all day. That is because he hunts at night. He is working while people are sleeping.

Can you tell an interesting story about a pet cat?

Science Words

When you are reading this book, you may find some words which are new. You may find some words which are rather hard for you to understand. This happens because you are reading about things which are new to you. You are reading about things which grown-ups like to study.

This dictionary will help you to find out about these new words. It will explain what they mean. It will tell you how to use them.

When you come to a word which seems new or hard to you, look for it in this dictionary.

Here is a good way to find your word in the dictionary. Do you want to find out about a beaver? Look for *beaver* among the words which begin with "b." Do you want to find out about *mercury*? Look for *mercury* among the words which begin with "m." Where will you look for the word *woodchuck*?

After each word you will find a number with the letter "p" before it. This number tells you the page on which the word is first used in this book. The number "I" shows you that the word was used in Book I of "Pathways in Science."

Your teacher will be glad to help you find your words in this dictionary. Be sure to let her know if you need help.

Apricot. A fruit much like a peach. Apricots are smaller than peaches (p. 38)

Badger. The badger is larger than a rabbit. Badgers work at night. They make their homes under the ground (p. 57)

Bank of a river. The sides of a river are its banks (p. 180)

Bark. The bark is the skin of the tree. Some trees have rough bark. Others have smooth bark (p. 40)

Barley. Barley is a grain. It grows in the fields. Did you ever eat barley soup? (p. 80)

Beaver. Beavers can cut down trees with their teeth. They build their houses in the water. Many beavers live and work together (p. 55; also in I)

Bed of a pond or stream. The bottom of the pond or stream is its bed (p. 56)

Beetle. Potato bugs are one kind of beetles. Beetles have a hard covering on their backs (p. 51)

Bulb. The stems of some plants grow under the ground. These stems are thick and round like a ball. Tulips and onions are stems like these. Such stems are called bulbs (p. 73)

Burdock. The hooks on burdock seeds help them to get many rides (p. 7)

Burrow. A hole which some animals dig under the ground. They make their homes in these holes or burrows (p. 55)

Catnip. A small weed which has soft, furry leaves and furry purple flowers. It often grows at the edge of gardens and near fences. Cats like to eat catnip leaves (p. 258)

Chatter. Chatter means to talk very fast. Sometimes birds seem to chatter instead of sing (p. 219)

Chili sauce. Chili sauce is made from chopped tomatoes and peppers cooked with vinegar. It is eaten with meats (p. 26)

Chipmunk. Can you tell the difference between a chipmunk and a squirrel? Look at his tail. Look at his stripes. A chipmunk is smaller than a squirrel (p. 57; also in I)

Coarse. Grains of sand are small and fine, but gravel is large and coarse (p. 156). *See also* Grain of soil

Cocoon. Have you ever watched a moth come out of a cocoon? (p. 8)

Collection. Some children have collections of shells. Others have collections of stamps or pictures (p. 162)

Cones. The seeds of trees that stay green all winter are in their cones. Have you ever found any cones on your Christmas tree? (p. 64)

Coonskin. Coonskin coats are made from the skins of raccoons (p. 235)

Cornstalk. A cornstalk is the tall stem which holds the leaves and the ears of corn (p. 243)

Coyote. A wild animal which looks much like a dog. Coyotes live on the plains (p. 198)

Damp. On rainy days our clothes feel damp. Forests are cool and damp. Plants need damp soil or ground in which to live (p. 100)

Degree. A thermometer helps us to measure heat. We measure money by dollars and cents. We measure height by feet and inches. We measure heat by degrees. We often write degree this way: °. When the thermometer says 32°, water will freeze (p. 115)

Den. The nests of some animals are called dens. Dens are made under the ground, under buildings, under stones, and in many other places (p. 230)

Dew. Dew is the tiny drops of water which we often find on grass and other plants in the morning (p. 124)

Drift. *See* snowdrift (p. 168)

Dune. Sometimes the wind is strong enough to blow sand into piles. These piles are called sand dunes (p. 168)

Enemy. An enemy is one who does harm to another. A large animal often is an enemy to a small animal. A cat is an enemy to a mouse (p. 66; also in I)

Evergreen trees. Some trees keep their leaves and are green all winter. They are called evergreen trees. The trees which we use for Christmas trees are evergreen trees (p. 43)

Exercise. Running is exercise. So are jumping and swimming. A person who is strong and well likes to exercise. Most animals like to exercise (p. 256)

Fiber. The very small roots of plants are sometimes called fibers. Fibers look like threads (p. 86)

Fine. Gravel is large and coarse. Grains of sand are very small and fine, but the grains in clay are finer than grains of sand (p. 156). *See also* Grain of soil

Flood. Sometimes a river becomes too full of water. Then the water runs over the river banks. When this water covers the land it is called a flood (p. 99)

Fog. Fogs are clouds which are close to the ground (p. 100)

Foghorn. A foghorn is a big horn which is blown during a fog. Ships carry foghorns. Sometimes ships cannot see each other during a fog, but they can hear each other's horns. Then each ship can tell where the other ship is (p. 102)

Footprint. The mark which a foot makes in the soft earth. Indians could follow wild animals by their footprints (p. 242)

Form. On a cold day you can watch ice form on the water in a pan (p. 106)

Freeze. When the air becomes very cold many things freeze. Water becomes cold and hard. When water freezes it turns to ice (p. 33)

Full-grown. Some insects are full-grown a week after hatching. Boys and girls are not full-grown until they are men and women. This takes many years (p. 232)

Goggles. Goggles are glasses. People wear them to keep the wind or bright sun from hurting their eyes (p. 234)

Grain of corn. A single piece of corn or wheat is called a grain (p. 64)

Grain of soil. A small, hard bit of soil or dirt is called a grain of soil (p. 156)

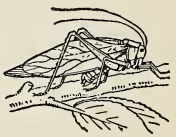
Guide. A guide is someone who shows you which way to go. Indians are good guides in strange forests. They show the hunters which way to go (p. 201)

Gum. A thick liquid called gum comes from cut places on some trees. This gum is sticky like sirup. It does not taste like sirup. It is very bitter (p. 91)

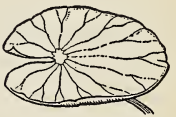
House plants. Plants which we grow in the house are house plants (p. 73; also in I)

Insect. Flies and crickets are insects. Insects hatch from eggs (p. 9; also in I)

Katydid. A katydid looks a little like a grasshopper. It looks like a cricket too. Did you ever see a katydid on a tree? They are hard to see. They are green like the leaves of the tree (p. 9)

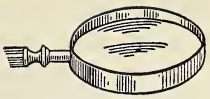


Lily pad. Some lily plants have leaves which are large and round. They float on the water. They are called lily pads (p. 207)



Liquid. Water, milk, and gasoline are liquids (p. 109)

Locust. An insect which is a kind of grasshopper. It is found in dry fields where it can be seen eating the grass and other plants. Locusts can jump into the air (p. 9)



Magnifying glass. The magnifying glass makes things look bigger than they are (p. 172; also in I)

Measure. We can measure with a ruler or a yardstick. Can you measure with a thermometer? (p. 115)

Mercury. Mercury is a shiny liquid which has a silver color. It is used in thermometers (p. 117)

Moss. Moss plants grow low and close together. They grow in damp, cool places. Sometimes moss grows on the ground. Sometimes it grows on damp wood. Sometimes it grows on stones. When moss grows on the ground, it looks like a green carpet. Some moss looks like green velvet (p. 67)

Moth. There are many kinds of moths. There are large moths which have beautiful colors. There are tiny, brown moths which sometimes eat our clothes (p. 48)

Museum. We can see and study interesting things in a museum (p. 204; also in I)

Mushroom. Did you know that mushrooms have no leaves or flowers? Some mushrooms are good to eat. Other mushrooms are not good to eat (p. 216)

Muskrat. Muskrats live near the water. They are larger than house rats. Muskrat fur is often made into coats (p. 55)

Narcissus. The narcissus blossom is white. It has a sweet smell (p. 73)

Oriole. The oriole builds a nest which looks like a bag. Some orioles are bright orange and black. Some are black and white (p. 41)

Pack. A number of wolves which travel together is called a pack (p. 254)

Pebble. A pebble is a little stone (p. 158)

Pocket gopher. A pocket gopher is a little animal which lives under the ground. It can carry soil or food in pockets in its cheeks (p. 227)

Porcupine. You would not care to pet a porcupine. In its fur are sharp quills like needles. Porcupines can cut through wood with their sharp teeth. On page 203 you will find a picture of a porcupine (p. 201; also in I)

Potato beetle. A full-grown potato beetle has a hard covering on its back, but the young ones do not. They eat the green potato plants, not the potatoes (p. 51)

Propeller. A weather-vane propeller is pushed by the air, but an airplane propeller pushes the air (p. 119)

Pupil. The dark spot in the center of your eyes is called the pupil. The pupil lets the light into your eyes so that you can see (p. 260)

Quartz. The sand at the seashore is made of quartz. It is hard and shiny. Glass is made from quartz (p. 188)

Quill. A porcupine's quills are as sharp as needles (p. 203; also in I)

Raccoon. Raccoons are great tree climbers (p. 234). You will find pictures of raccoons on pages 237 and 241

Reservoir. Water is stored in reservoirs. Some reservoirs look like beautiful lakes (p. 98)

Root hairs. The smallest, finest roots of plants are called root hairs (p. 76)

Rubbish. Stuff which is no good and which we throw away. Old papers, sticks, leaves, pieces of cloth, twigs from trees are rubbish which we often find out of doors (p. 177)

Rye. Some people eat rye bread. It is made from rye flour. Rye grows like wheat (p. 80)

Salted meat. Sometimes meat is packed in salt to keep it from spoiling. Codfish is often packed in salt (p. 201)

Sandstone. It is easy to see the grains of sand in sandstone rock (p. 178; also in I)

Seashore. The seashore is a fine place to play because of the sand and water (p. 156)

Shale. Shale is a soft rock made from clay. The clay must be pressed very hard in order to make rock (p. 179)

Skunk. Skunks are small animals. They are black and white. They have long, bushy tails (p. 222). There are pictures of skunks on pages 223 and 229

Snowdrift. A wind can often blow snow into large piles. These piles or drifts are called snowdrifts (p. 168)

Soil. Soil is what most children call "dirt" or "earth." Plants grow in soil. The sand at the seashore is soil (p. 155; also in I)

Solid. A stone is solid. A book is solid. Ice is solid. What else can you name that is solid? (p. 109)

Sparkling. *Sparkling* means "shiny." A diamond sparkles (p. 187)

Spiced. Foods which are spiced have a good flavor (p. 26)

Steam pipe. Pipes which carry steam are called steam pipes. Some steam pipes carry steam from a boiler in the cellar to the radiators above. Some steam pipes carry the steam from one building to another (p. 231)

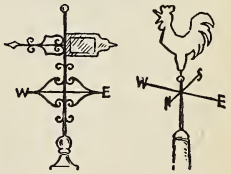
Stripes. Do you like to look at the beautiful red and white stripes in the flag? (p. 51)

Swiss chard. We eat the leaves of the Swiss chard plants (p. 81)

Thermometer. Thermometers tell us how warm or how cold things are (p. 113; also in I)

Thick coat. In the winter time we wear thick, warm clothes (p. 43)

Vane. These weather vanes show which way the wind is blowing (p. 119)



View. Did you ever stand on a high place and look at beautiful hills, sky, and houses? You were looking at a beautiful view. Look at the colored picture at the beginning of the book. This shows you a beautiful view (p. 127)

Water level. The top of the water in a lake or river is called the water level (p. 56)

Wear away. Even a little brook will wear away the soil or dirt in a meadow (p. 164)

Weasel. A weasel has a long, narrow body. He can climb into all kinds of places. He can climb into trees. He can climb into holes under ground. He is the enemy of many different kinds of animals (p. 198)

Weather. Hot and cold days, rainy and sunshiny days make the weather (p. 97)

Winter-killed. Plants are sometimes killed by the cold in winter. We say that they have been "winter-killed" (p. 103)

Woodchuck. A woodchuck lives in the fields and meadows (p. 57; also in I)

Woven. Did you ever weave a basket or a mat? Some baskets are woven from straw. Cloth is woven from threads (p. 204)

Index

How to Use this Index

This index will help you to find the things which you want to read about in "Out-of-Doors." It shows you what pages tell about butterflies, the moon, or other things in which you are interested.

Suppose that you want to read about butterflies. Butterflies begins with the letter "B." Look through the index until you come to the letter "B." Say your A B C's. The letter "B" will be found near the beginning of the index because it is near the beginning of the alphabet.

You will find a number of words which begin with "B." Look through these words until you come to the word *Butterflies.*

Beside the word *Butterflies* you will see the number 48. This is the number of the page which tells about butterflies. Look on page 48. There is your story about butterflies.

After the word *Snakes* you will see the numbers 53, 219. What do you think these numbers mean? Look on these pages to see if you are right.

The Index

P

R

S